The Welding Engineer

Welding • Cutting • Brazing • Flame-Treating • Metallizing
Design • Construction • Production • Inspection • Maintenance

MEMBER

Associated Business Papers
Audit Bureau of Circulations
American Welding Society
International Acetylene Association

G. H. MACKENZIE
President and Treasurer

T. B. JEFFERSON
Editor

CLYDE B. CLASON
Associate Editor

ROBERT L. SIMON
Promotion Manager

Eastern Representative:
T. E. DEPEW, 1819 Broadway
New York 23, N. Y.
Tel. Circle 7-1291

Midwest Representative:
D. R. WATSON, 400 W. Madison St.,
Chicago 6, Tel. Andover 5481

Pacific Representative:
W. R. McINTYRE, 832 W. 5th St.
Los Angeles 13, Tel. Mutual 6306

Published on the 10th of each month by The Welding Engineer Publishing Co., 506 So. Wabash Ave., Chicago 5. Phone Webster 7134.

Copyright, 1945, by The Welding Engineer Publishing Co.

Subscription, United States, possessions, and Canada, $3 a year; foreign countries, $4 a year; single copy, 35 cents. Entered as second-class matter January 20, 1916, at the postoffice at Chicago, Illinois, under the act of March 3, 1879.

FOREIGN REPRESENTATIVES: AUSTRALIA and NEW ZEALAND—R. Hill, Matlock House, Davenport, Auckland, New Zealand; BRAZIL—Alpha Jewel, Caixa Postal No. 2411, Rio de Janeiro, Brazil; GREAT BRITAIN—A. D. Baynes, 1 Cambridge Park Court, Twickenham, Middlesex, England; SOUTH AFRICA—J. W. Arnison, 35a Victoria Avenue, Benoni, Transvaal, South Africa; U. S. S. R.—Mesdunarodnaja Kniga-Kusnezki Most 18, Moscow, U. S. S. R.

VOL. XXX, NO. 7 JULY, 1945

IN THIS ISSUE

ARTICLES

Flame-Hardening on Railroads 35
ARTHUR HAVENS

Welding the Weasel 40
CLYDE B. CLASON

Flash Welding Rings 44
DR. I. A. OEHLER and ROBERT E. GOODMAN

War-Wearies Rejuvenated 48

Pipe Lines for "Pluto" 49

America's Answer—the JB-2 52
T. B. JEFFERSON

Editorial 33

On the Job 58

Short Cuts and Kinks 62

New Products to Use 64

Engineering Data Sheet No. 58 71

The Technical Slant 73

News of the Industry 78

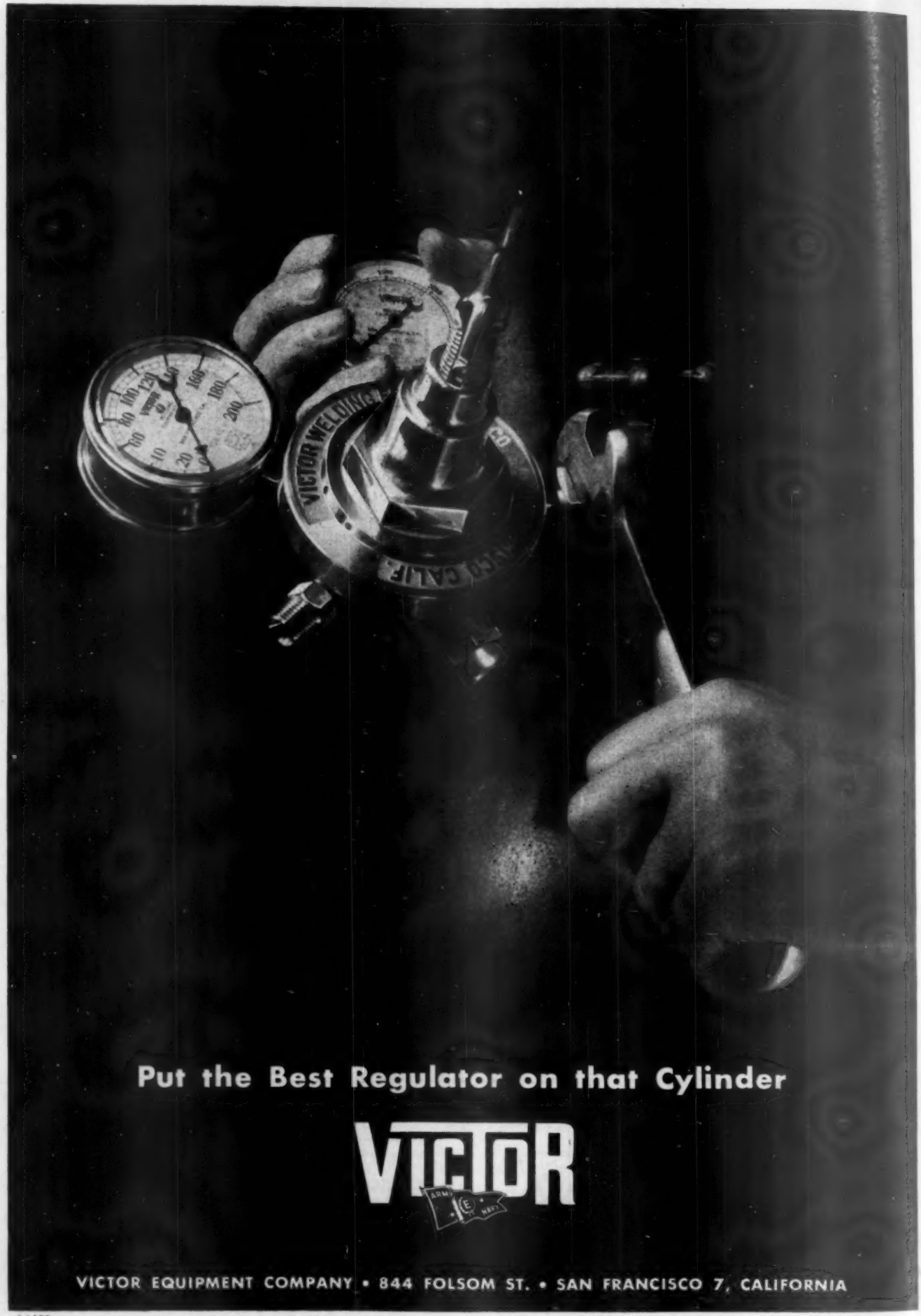
About People 84

Helpful Literature Just Published 90

From the Patent Office 94

Classified 111

Index to Advertisers 112


VICTOR WELDING
Put the Best Regulator on that Cylinder
VICTOR
VICTOR EQUIPMENT COMPANY • 844 FOLSOM ST. • SAN FRANCISCO 7, CALIFORNIA

Ad 133

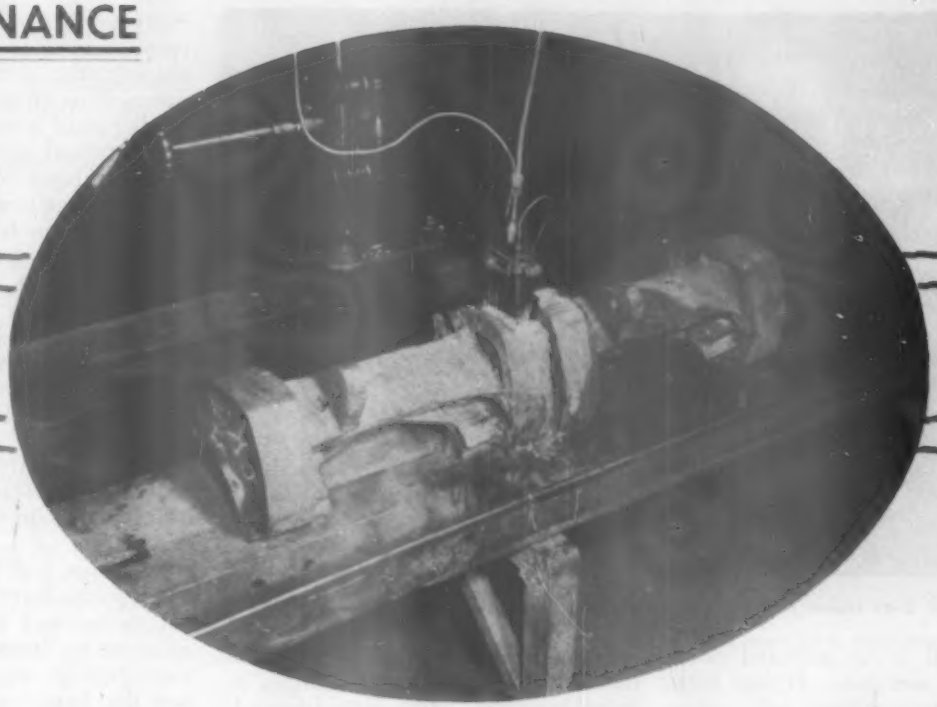


Fig. 1—These heating tips are arranged to fit the curved contour of an engine truck rocker casting.

Flame-Hardening on Railroads

Oxygen and acetylene are supplying an important new service to railroad maintenance. All types of locomotive and many passenger and freight car parts are being flame-hardened for increased wear resistance.

By ARTHUR HAVENS

For the past thirty years the combination of oxygen and acetylene has played an ever increasingly important part in the repair and maintenance of locomotives and cars. It has often been said, "Give a good, ingenious mechanic a welding and cutting outfit and he will make you most anything or do most any kind of a repair job." This statement may be just a little far fetched, but in substance it is entirely correct.

Printed in this magazine during the past has been a continuous succession of articles and stories depicting the methods and applications used by all types of manufacturers and railroads—each a pronounced success for welding equipment. In this article, however, I propose to leave welding temporarily in order to discuss a closely allied process.

Early Applications

Down through the years it has not been uncommon for a machinist to approach a weldor with a request to harden something for him. Flame-heating and quenching usually did the job to the machinist's full satisfaction. Occasionally in the case of a low-carbon-steel part the weldor would use a carburizing flame to introduce a little more carbon into the surface and so make the part a little harder than if it had been left untreated. Who would have realized in those early days that this process of flame-hardening would develop into a widely accepted, highly efficient technique for hardening all types of machine and locomotive parts?

As a railroad weldor, I will have to confine this article to flame-hardening applications on the railroad, where flame-hardening has made rapid strides in the past few years.*

We are all acquainted with the fact that the development of alloy steels and the subsequent methods of heat treating have made possible physical, chemical and dimensional tolerances heretofore impossible. Even so, the residual stresses and distortion in certain parts, caused by the usual method of case hardening and quenching with water, air or oil, sometimes leaves a part in an unsatisfactory condition, and it is then necessary to draw the hardness back to 250 or 300 Brinell so that the part can be machined to dimensional accuracy. Before going too far into this interesting subject, however, perhaps it would be well to review briefly the history of flame-hardening.

As early as 1925 steps were taken to develop a process of oxy-acetylene hardening that would make it possible to harden parts that could not be handled by the usual processes because of distortion or unsatisfactory wear resistance.

A process of flame-hardening was in use at this time in England by the Metropolitan Vickers Co. and the Patent Gear Hardening Co. This process was distinctly radical and definitely successful. Development was hindered somewhat at the outset by the lack of suitable water-cooled apparatus capable of maintaining broad areas of stable oxy-acetylene flames in close contact with the heated metal. Because of this lack, only one flame could be used and that only on a restricted surface area.

First Used for Rail Ends

Probably the first widely accepted use in this country was the hardening of rail ends. The oxy-acetylene reclamation of battered rail joints had

*For further information on the flame-hardening process see *The Welding Encyclopedia* or the three articles titled "The Hardening Flame," which appeared in THE WELDING ENGINEER for January, February and March, 1943.

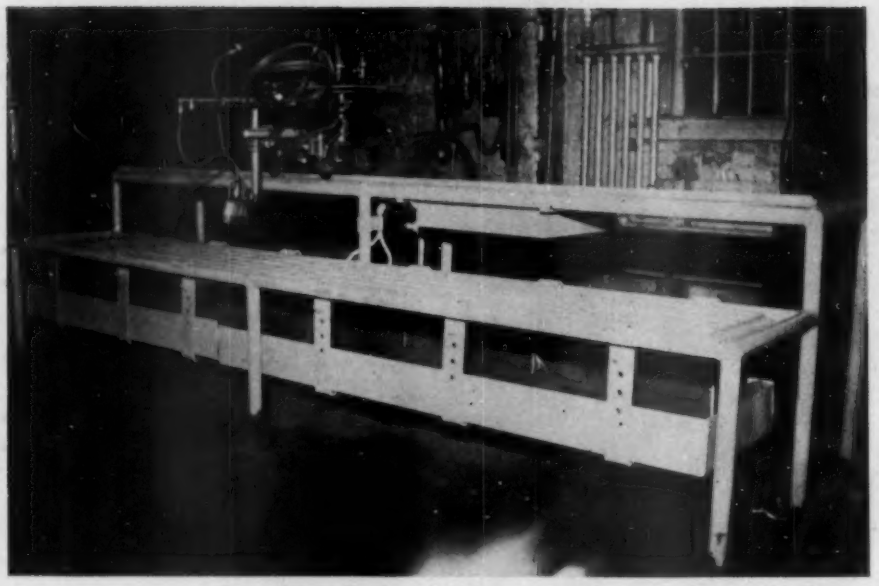


Fig. 2—A typical home-constructed arrangement for flame-hardening.

been and still is an accepted practice on most railroads. It had been discovered that welded rail joints wore more satisfactorily than the rail in its original treated condition. Some ambitious and ingenious weldor then asked why couldn't we try to harden the rail end in order to eliminate some of the batter? The idea seemed good and was tried out. We all know of the success of this now accepted practice.

With this application as a starter, the companies interested in railroad welding immediately began to develop apparatus and techniques that would permit flame-hardening to be used on all locomotive parts subjected to abrasive wear and having a carbon content suitable to this then radically different method of raising the wear resistance.

Much has been learned since those early days. At first it was thought that flame-hardening like case hardening changed the chemical composition of the part; this was found to be untrue. It was also considered that the weldor using an excess acetylene or carburizing flame imparted additional carbon to the steel; this is not always true. The truth is that when a strictly neutral flame is used as a heating medium the hardness is produced by quenching the surface of the steel while it is still above the critical temperature. The intense oxy-acetylene flame induces heat so rapidly that it penetrates the material only a fraction of an inch. The effect is to impart to the surface of the metal a hardened case, which may vary in depth from a mere skin to ¼ in., depending on the composition of the base metal, on the operating methods used, the length of the heating time, the quenching medium etc.

It may be interesting to note that there are practically no failures in flame-hardened parts, notwithstanding that fully 80% of the failures hardened by other methods are caused by residual quenching stresses. The paradox is no doubt due to the fact that in the flame-hardened part there is no hardening deeper than from 1/16 in. to ⅜ in. below the surface. The balance of the metal remains in an annealed, soft condition that has a minimum of stresses.

Flame-Hardening Heads

The welding equipment companies responsible for the research in this new field have developed several special heating heads for flame-hardening locomotive and car parts. Two of these, however, will cover almost every application. The larger of the two covers an area 4 in. wide but is so shaped that several heads can be grouped to cover wider areas. The smaller head is made to cover a width of up to and including 1½ in. Both units are water-cooled.

The larger head has outlets for 30 small screw-in type tips; the smaller head has outlets for seven tips of the same type. The tips vary in length from 9/16 to 1 7/16 in., and in orifice dimensions from No. 65 to No. 50 drill sizes.† Orifice sizes in the tips vary so that they can be adjusted for different classes of work such as adjacent thick and thin sections. Small copper plugs are furnished for the 30 flame heads so that sections may be blanked out when that is found necessary.

The tips can be grouped in the heads to conform to the many different shapes and sizes of various objects to be treated. By placing the short tips at the center of the head and the long tips at the edges, the flame contour can be made to fit the curved surface to be hardened on an engine or trailer truck rocker casting (Fig. 1). As an alternative, the long tips may be placed at the center and the short tips at the edge of the head to provide a flame contour fitting a concave surface such as the bottom seat on both engine and trailer truck rockers.

Quench and Cooling Water

The cooling water is furnished through a ¼ in. OD copper tube. The water circulates through the hollow head and is exhausted through a

†For orifice diameters see Engineering Data Sheet No. 53, The Welding Engineer, Feb., 1945, page 81.

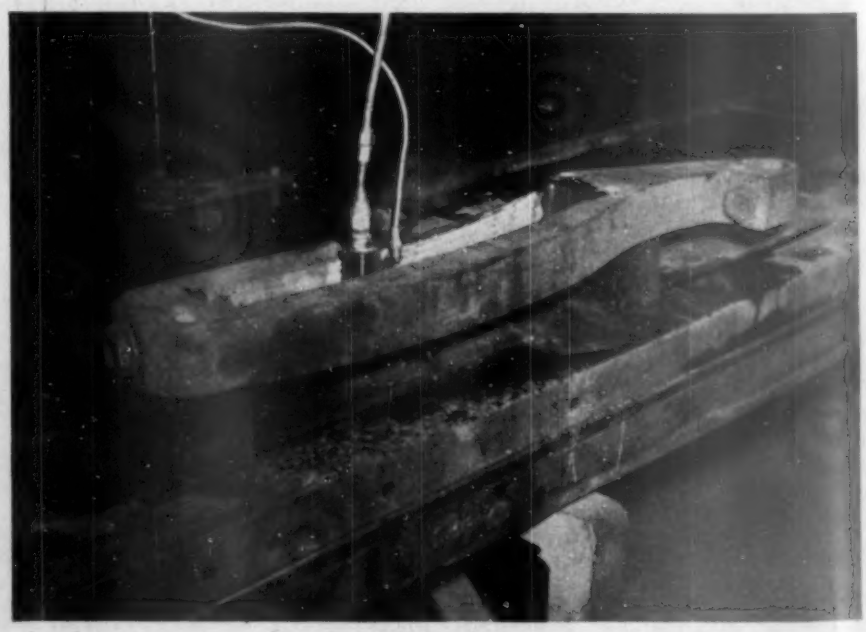


Fig. 3—Locomotive links can be flame-hardened with a distortion of less than 0.002 in.

suitable outlet connection at the top. The quenching heads are connected directly to this water outlet and are placed immediately adjacent to the heating head.

The water-quench head is merely a brass block in which have been drilled two rows of No. 60 drill-size holes on ⅛ in. centers. The holes are made in a staggered pattern to provide an almost solid sheet of water. The water jets strike the metal about ½ to ¾ in. away from the last row of heating flames. The water outlets are drilled at an angle so that the sheet of water will not interfere with nor bounce back into the flame.

Flame-hardening, like machine flame-cutting, must be done on some sort of a machine. Either the flame-hardening heads must be stationary or the work must be held rigid. I believe the latter is the more common practice, for in most railroad shops equipped with machine gas-cutting equipment it is a simple matter to attach flame-hardening heads to the carriage of the cutting machine and use it to guide the heads over the work at the desired speed. Water catch pans must be affixed in convenient places to keep the area around the machine relatively clean. Fig. 2 illustrates a typical home-rigged flame-hardening set-up.

Hardenable Materials

Obviously, not every steel can be hardened by this process. To obtain a reasonable increase in hardness, the steel should contain at least 0.40% carbon. As the carbon content increases, the hardness obtainable likewise increases. The general range of hardenable plain-carbon steels is from 0.35 to 0.70% C. All steels in this range can be flame-hardened without any special care or precaution to prevent checking. With steel above 0.70% C, it is best to provide a less drastic quench than water; *i.e.*, either air or a fine mist. This is not apt to bother the railroad flame-hardener as most locomotive parts are forged from scrap axles and this steel has been found to lend itself readily to the flame-hardening process. If much flame-hardening is to be done, however, it is advisable to procure from the railroad engineering department a table showing in detail the exact carbon content of all parts to be hardened. In this manner the operator will know exactly the speed to operate and the results to expect.

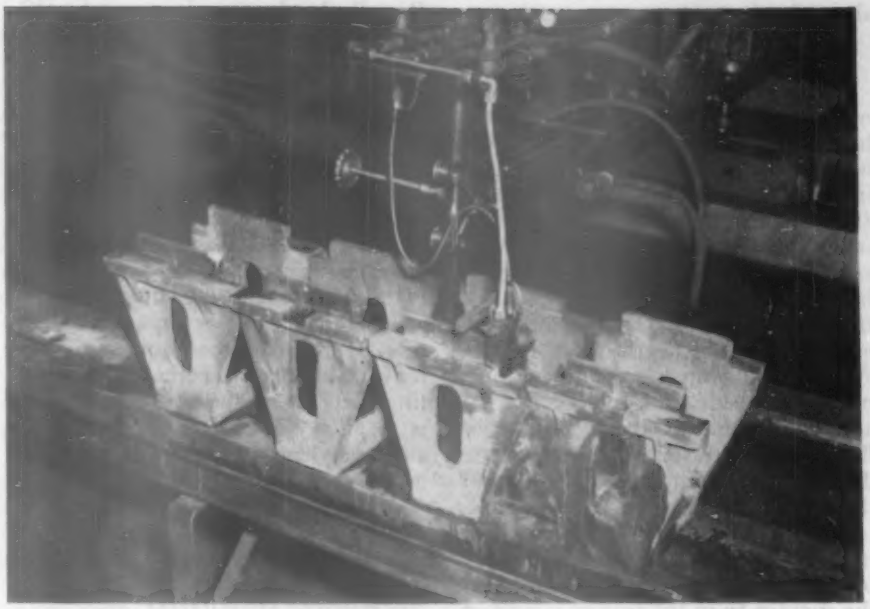
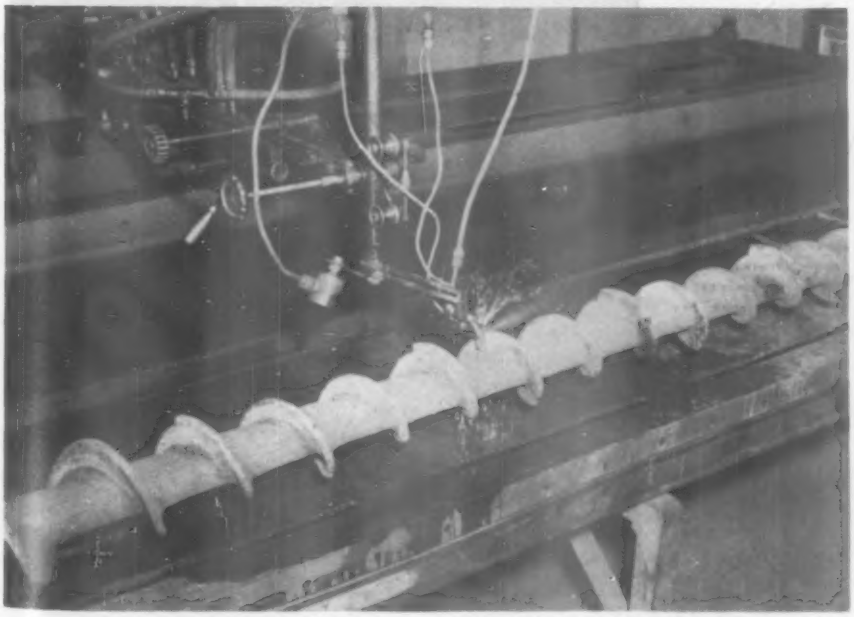


Fig. 5—A locomotive spring saddle can be flame-hardened in four minutes.

Fig. 4—Flame-hardening the flight on a stoker conveyor screw. This job requires a rather complicated set-up, but the results make it well worth the trouble.



Crosshead Guides

Locomotive crosshead guides have long presented a problem to the motive power department because they wear so rapidly. Located as they are, they are bound to be covered with dirt and sand, and although several different types of guides have been tried the results are relatively the same. It has been customary to rebuild and replace the lateral wear with either arc or oxy-acetylene welding. This method of reclamation has been satisfactory, the only trouble being that it must be done at each general shopping. Attempts have been made to harden these long, heavy bars of steel, but the distortion was so great that the practice was abandoned. Preventing wear at this spot being so important, it is only natural that crosshead guides would be one of the first applications of flame-hardening on the locomotive.

Locomotive guides are generally made from scrap axles and have a carbon content running between 0.45 and 0.50%. This material is ideal for flame-hardening. The Brinell reading on the guides in their as-forged-and-machined condition is from 180 to 200, but after a thorough flame-hardening the reading is raised to between 500 and 600 Brinell. Obviously, this increases the wearing qualities of the guides tremendously; in an actual mileage test of 50,000 miles an unhardened guide was worn ⅛ in. while the flame-hardened guide on the other side of the locomotive was worn only 0.007 in. It can be readily understood why flame-hardening of guides has become a standard practice in all

shops having the proper equipment.

Links and Blocks

Another application that seems to me equally important is the flame-hardening of locomotive links and blocks. Here again the parts are out in the open and subject to abrasion from flying particles of sand and other substances that fly around a locomotive in motion. In the past we have attempted all sorts of repairs to the links and blocks, but flame-hardening proved to be the best answer. After rigging up a suitable arrangement, the inside of the link (Fig. 3) and the outside of the block can be flame-hardened so that wear is reduced to a minimum. Distortion of the flame-hardened link is negligible.

As explained earlier, flame-hardening is only a surface hardening; this being true, it is vitally important that the surface be in the proper condition to react successfully to the heat-quench process. During forging, casting, normalizing, annealing or certain heat-treating processes, carbon may be extracted from the surface of the material, leaving one or more decarburized surface zones which will not harden.

Preliminary Precautions

It is essential that all decarburized surfaces be removed prior to the hardening operation; if not removed soft spots will appear in these zones. The decarburized area can be removed by machining or grinding, whichever is the most convenient.

In using the metal arc or oxy-acetylene welding to reclaim a part before machining and hardening, it is necessary to fuse the metal well and avoid laps or cold shuts. Seams or laps develop cracks during the quenching operation. Pits or blowholes in the metal surface should also be eliminated before flame-hardening. Scale has a heat-retarding influence; where maximum hardness is desired all scale should be removed. This can be done either by oxy-acetylene flame-cleaning or with a portable grinder or wire brush.

Flights on Conveyor Screws

Among the long list of flame-hardening applications, the hardening of stoker conveyor and elevator screws (Fig. 4) stands out as a real economy and time saver. Previously, it had been a standard practice to rebuild the worn flights on these screws with soft steel welding rods; while this method was satisfactory for a repair job, the rebuilt flight did not last as long as might be expected. Use of a high-carbon welding rod resulted in a better wearing stoker screw with a Brinell hardness of around 350. When flame-hardening was used on the same stoker screws welded with high-carbon steel, the Brinell hardness was raised to 550. The hubs as well as the flights are now flame-hardened successfully.

The question is often raised: "Is the cost of flame-hardening prohibitive?" It is not. Labor costs, of course, vary in different shops, but the cost of a flame-hardening operation remains fairly stable because the hourly rate of railroad mechanics is quite universal. A good method of estimating the cost of the gases to be used is to allow ¼ cu ft of both oxygen and acetylene to flame-harden 1 sq in. of steel.

Spring Saddles

Anyone who has witnessed the condition of locomotive spring saddles removed after 100,000 miles service will appreciate the advantages of flame-hardening. If the wear on this important locomotive part alone is considered, it is bad but not overly serious. When spring saddles wear, however, they usually tip toward the driving wheels, throwing the entire spring rigging out against the locomotive frame. This causes the spring hangers to wear into the frame and heads of the hanger pins to wear dangerously thin where they chafe against the tire. By flame-hardening the spring saddles, we have hopes of eliminating all of these aggravations.

The saddles are annealed and overhauled as usual in the blacksmith shop, but the blacksmith deliberately leaves them a little short. The size deficiency is made up by weld deposits of high-carbon steel hammered to the desired size. When several saddles have been thus prepared, they are lined up on the flame-hardening machine (Fig. 5), and each is hardened in about four minutes. Flame-hardened saddles inspected after 80,000 miles revealed no discernible wear. Saddle-type equalizers and other types of spring equalizers treated in the same manner have been known to run 165,000 miles with little or no wear.

Locomotive men are also experimenting with the spring saddle seat in the top of the driving box. Some are milling out the seat and inserting a piece of hard steel ⅜ in. thick, others are building up the top of the driving box or spring saddle seat with wear-resisting welding rod. Both methods are working out satisfactorily.

Shoe and Wedge Channels

Other elements on the driving box that receive a great amount of wear are shoe and wedge channels—so much wear, in fact, that the boxes must be planed at each shopping and hence are soon cut so thin that they must be scrapped. The welding of liners of steel plate in the shoe and wedge channels has cut down on the replacement of driving boxes tremendously, and now flame-hardening is adding greatly increased resistance to wear.

The liners are forged from axle steel and machined to the desired thickness. They are then cut down about 4 in. on each edge for welding. One end of the liner is welded securely; the other end is clamped down. The liner is then flame-hardened, and its free end welded after the harden-

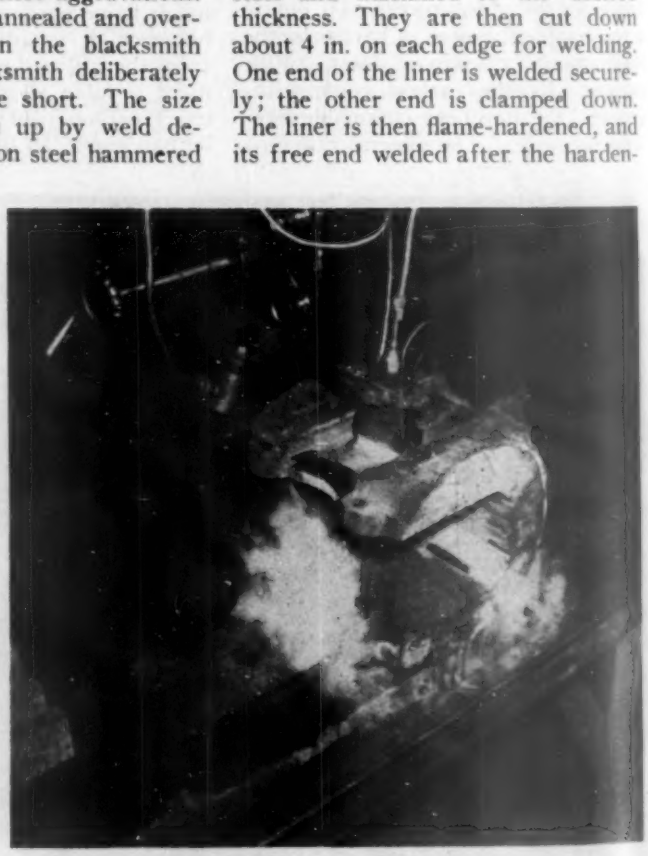


Fig. 6—Cast-iron journal boxes for engine trucks readily lend themselves to hardening with the oxy-acetylene flame.

ing operation has been completed. If both ends were welded before the hardening, one end would generally break loose during the operation.

The wearing surfaces or channels of journal boxes for engine trucks, trailer trucks or passenger cars are all hardened successfully. Some of these boxes are of cast iron (Fig. 6), but this makes little difference except that the Brinell hardness will run a trifle lower than the same part made from axle steel or some similar material.

Also applying to both cast iron and steel is the hardening of the ring grooves in locomotive piston heads. It is not uncommon to be forced to replace a worn piston head simply because the ring grooves have worn, for if the rings are permitted to slap around in the groove they will wear excessively and increase the possibility of a blowing piston. On steel piston heads, the hardness of the ring grooves has been raised to 500 Brinell in a 30 minute operation. The cast-iron operation is still in the experimental stage, but excellent results are expected.

Pins and Crossheads

As we all know, a locomotive is literally pinned together with wrist pins, knuckle pins, spring hanger pins, trailer center pins, brake hanger pins, equalizer pins and what not. Though varying in size from 1 in. diameter all the way up to a wrist pin as big as 5 in. in diameter, all of these pins can be flame-hardened economically. A test made on a flame-hardened locomotive wrist pin proved that it is possible to expect as much as 100,000 miles of service with less than 0.002 in. wear.

The valve crosshead is another part that has always given trouble about wearing rapidly. Babbitt metal was used for several years to compensate for excessive wear. This was a bothersome job: as soon as a crosshead became worn it was necessary to remove it, take it to the shop, put the head in a mold, pour babbitt around it and finally machine it all over. The entire operation required several hours. Now we are eliminating much of the wear with the flame-hardened valve crosshead (Fig. 7). The valve crosshead in flame-hardened condition will go several shoppings without attention.

Swing Link Rockers

Locomotive trailer truck and engine truck swing link rockers are noted for wearing out; in fact most railroad weldors have a spare set to work on in slack times. This complete set is welded and hammered back to size so that it will be ready to apply in a hurry when needed. Originally, the parts were welded with mild-steel rod; a harder welding rod naturally increased the useful life of the rockers but still left something to be desired. The best results so far have been with rockers welded with a high-carbon steel and then flame-hardened. These rockers can practically be forgotten, for routine inspection reveals no signs of wear after 110,000 miles.

Most chafing irons or, as they are sometimes called, radial buffers are made with a chilled surface. When this becomes worn, it prevents a smooth, even movement of the sliding plate across the surface of the buffer. It is now standard practice to rebuild the contour and then flame-harden it, and it is not unreasonable to expect 100,000 miles of service without any signs of wear from castings so treated.

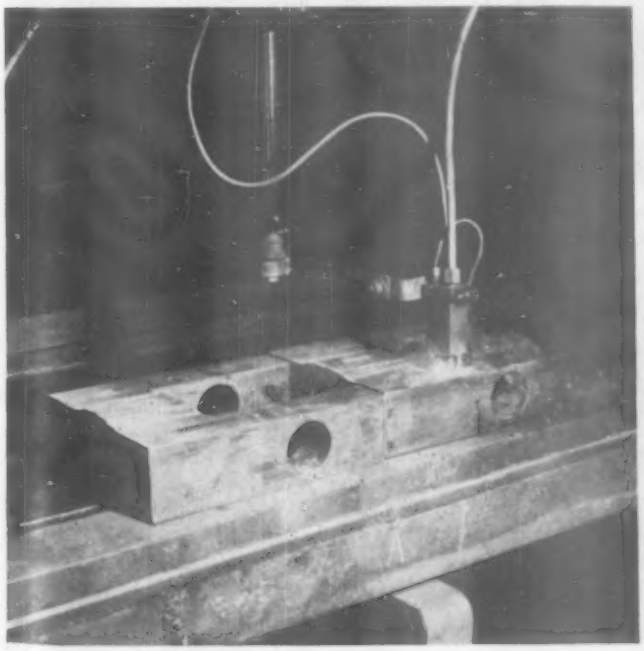


Fig. 7—Flame-hardening a valve crosshead with a seven-flame head. This part used to wear rapidly, necessitating the application of babbitt metal to compensate for the worn surfaces.

Car Shop Applications

So far we have confined our attention to the locomotive, but this by no means includes all of the possible applications for flame-hardening on the railroad. There are almost unlimited possibilities in the freight and passenger car shops—lots of them as yet undeveloped.

A few flame-hardened applications that have already been accepted in car shops are: draft keys flame-hardened to 500 Brinell; flame-hardened cast-iron and steel pulleys for V-type and flat belts; equalizer seat inserts for journal boxes; various wear plates made of carbon steel for riveting or welding to wearing surfaces; half pedestal castings; draft gear V-blocks; coupler carrier irons; coupler lock blocks and side and center buffer stems.

Drive wheels on turntables represent one of the most recent flame-hardening applications. In busy terminals—where there are dispatchments every few minutes—the turntable is going all the time. Obviously, a shutdown of the table causes a great deal of difficulty. To multiply the wearing life of these wheels four or five times by using flame-hardening is not uncommon, and it can be readily appreciated that this is a great boon to the roundhouse foreman.

Naturally, the flame-hardening process has many limitations; these, however, are rapidly being overcome by the tireless research and experience of those interested.

Future Looks Bright

Although it might appear that flame-hardening on the railroad has reached its peak, it is more reasonable to assume that it is still in its infancy. New applications are being discovered almost daily, and it would even be extremely difficult to set down all of the different ones that are now in use.

Many wild and seemingly fantastic predictions are being made, and no doubt some of these will be realized. Only a few years ago it would have been deemed utterly impossible to flame-harden the teeth of a gear 8 ft in diameter and weighing 4 tons; today such a job is common practice. In closing, I would like to emphasize that the process has given to industry a valuable new tool that permits the hardening of many parts heretofore impracticable to harden by any of the older heat-treating methods.

Welding the Weasel

On June 6, 1944, the long awaited Allied invasion of France was accompanied by hundreds of square-shaped, low-slung, track-laying carriers making their first appearance in number under combat conditions. Officially christened by the Army as the M-29, the vehicle shown in Fig. 1 quickly received the name of the "Weasel" because of its ability to dash into and dart away from tough spots and its amazing maneuverability over all kinds of terrain.

No Arms, No Armor

A true secret weapon—the secret of its very existence had been well kept for the two years prior to D-day—the Weasel is neither an armored car nor a tank but a lightweight cargo and personnel carrier. It carries neither arms nor armor but depends solely upon speed and maneuverability to bring it safely through and out of the combat zone. As versatile as it is maneuverable, the Weasel can perform innumerable battle jobs: rush small groups of soldiers and supplies to strategic spots, bring wounded soldiers back to first-aid stations, deliver rations and munitions or tow light artillery pieces. It will traverse snow, sand, swampland or tidal mud, break its own trail through underbrush and second-growth timber, swim in deep water and nest within a cargo plane for transportation by air.

The story of the Weasel really begins in the dark days of May, 1942, when the Japs were surging over the Aleutians and seemed about ready to occupy all of Alaska. In that gloomy month representatives of the War Department and Ordnance engineers came to Studebaker with a request to produce a vehicle that could transport troops and supplies over deep snow.

Fig. 1—A radical vehicle of war which was in secret production at the Studebaker automobile factory in South Bend, Ind., for almost two years is the "Weasel," a low-slung, square-faced personnel and supply carrier. Because of its light weight and broad, semiflexible tracks, it can operate over terrain impassable to wheeled or even other track-laying vehicles.

Alaska to the South Pacific

The first Weasels—weirdly camouflaged in black-and-white patterns that blended indistinguishably into snowy landscapes—proved eminently satisfactory for the purpose for which they had been designed. Experience soon showed, however, that the Weasel's light weight, rugged construction and all-around mobility were features fitting it for a much wider scope in the global conflict. With colors changed to the familiar Army olive drab, the Weasel was given a preview of battle service in Italy and later made its world premiere with the Allied land armies lunging across the Channel for the first big bite at Axis-held territory in the West.

Nor has the Weasel confined its operations to Alaska and the European continent—busy as it has been in both of these areas. In the Southwest Pacific it has snaked its way through Bougainville cane grass and marshes impassable to any other carrier. It has drawn 57 mm guns through heavy mud, towed collapsible rubber landing boats to operational areas and pulled trailers loaded with badly wanted K rations and other supplies. It has also been adopted by the Navy for air crash rescue work. Its two broad, ribbed tracks, extending the full length of the body, enable it to dig in just about anywhere, and its low center of gravity permits it to

Prior to D-day, one of the Army's most secret weapons was the Weasel, lightweight cargo and personnel carrier. The truth can now be told: the Weasel is all-welded, and all welding processes are required for its manufacture.

By **CLYDE B. CLASON**

shoot effortlessly up slopes as steep as 45 degrees.

Land Weasel

In appearance, the M-29 Weasel is squat and square-cornered. Its body measures 125 in. long, 65 in. wide and 51 in. high, with a ground clearance of 11 in. Its six-cylinder Studebaker "Champion" engine is mounted inside the tonneau, behind the instrument panel at the driver's right. The rear space either carries three passengers (official number) or can be devoted entirely to cargo.

The rubber-padded tracks have steel grouser plates 1 in. high welded to their support plates. Some 200 designs were tried and rejected before the near-perfect track pattern was found. The two tracks are held in position by 32 independently sprung bogie wheels, 16 on each side. Clutch and transmission are the same as the Studebaker "Champion" passenger car, yet the Weasel has six forward and two reverse speeds; this is made possible by a two-speed axle shifted by means of an auxiliary gear lever. The driver steers with two levers, each of which is linked to a brake on its respective driving sprocket. A pull on the left lever, for instance, slows the left-hand sprocket, causing the vehicle to swing toward the left. The Weasel can be turned completely around in a 12 ft radius. Its top speed on a hard surfaced road is approximately 36 mph.

Amphibious Weasel

Could the Weasel be made to swim? asked military authorities. Very easily, replied Studebaker engineers. Since its welded steel hull was already watertight, to turn it into a true amphibian it was only necessary to add floats at bow and stern. The added bow was shaped to permit the land craft to cut through the water, and two hinged rudders were installed at the stern for steering. These rudders are connected by cable with a tiller, located on the dash in front of the driver. The two standard tracks provide the means of propulsion when the Weasel takes to water in much the same manner as the paddle wheels of the old-fashioned river steamer.

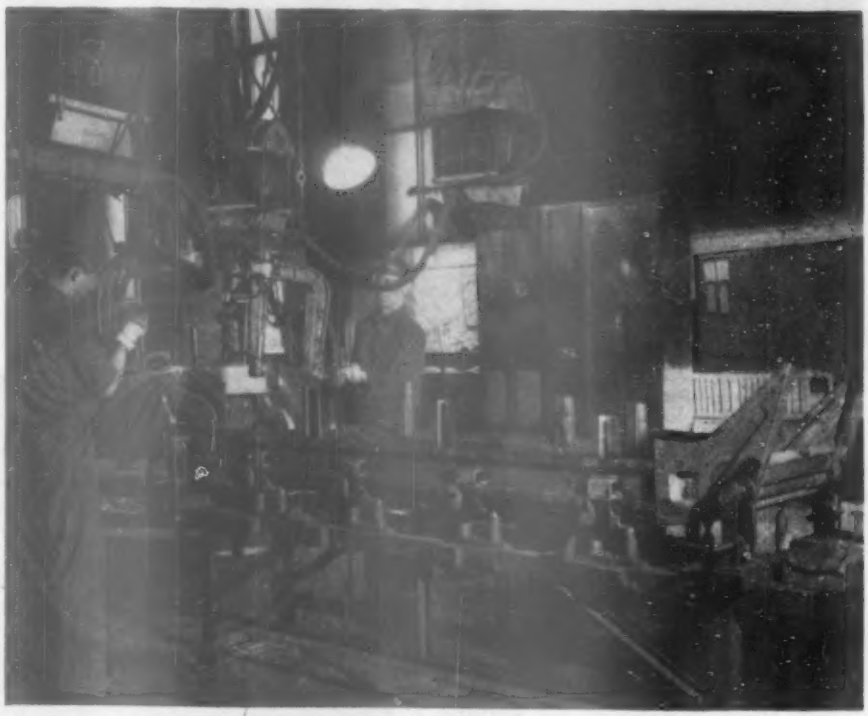
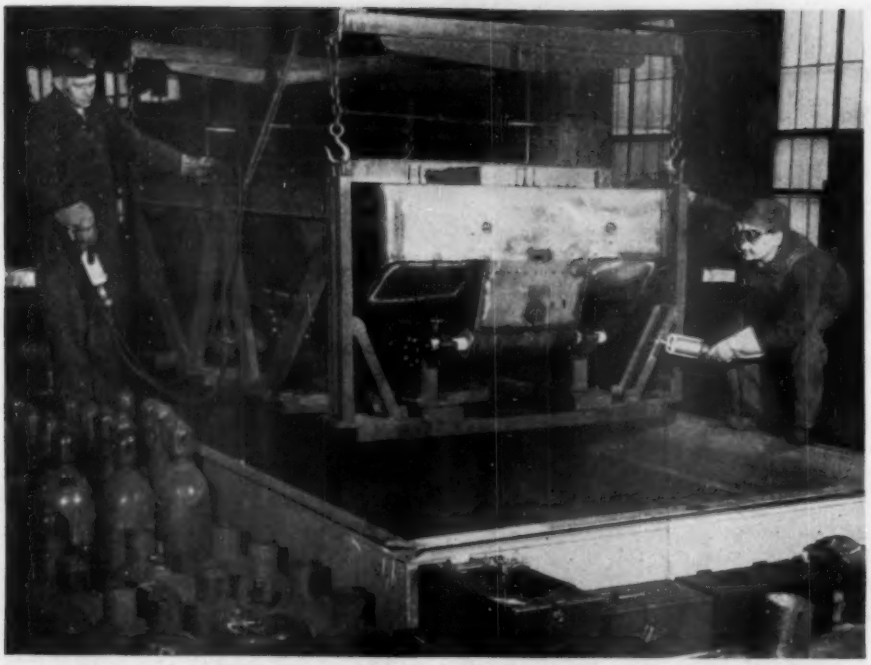


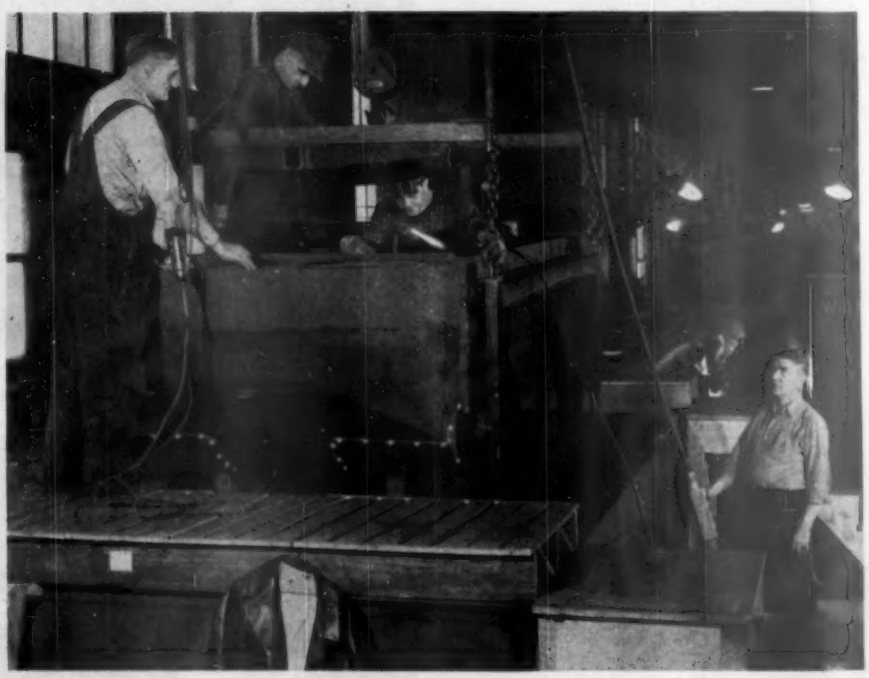
Fig. 2—Gun welding the front and rear housing brackets to the hull bottom or keel assembly—the first unit on the main assembly line.

Fig. 3—All of the spot-welded seams are sealed to render them watertight. Here the sealing is being done by arc welding. Quick-acting clamps facilitate the transfer of the keel assembly from jig to jig.



ABOVE

Fig. 4—The completed Weasel hull is lowered into a water tank in one of the three tests for leakage at the Studebaker plant. The welded supporting cradle in which it is being lowered weighs 3,900 lb and will carry it immediately to the bottom of the tank.



RIGHT

Fig. 5—Leaky seams discovered in the water test are repaired by oxy-acetylene welding.

The tracks are completely submerged when the vehicle is afloat. Hence track side panels or aprons were draped over the topside of the tracks to reduce water turbulence. These steel skirts cover all of the undercarriage above the center of the track idler wheels. Water pumped forward by the return track (upper half) is utilized to add to the propulsive force. In calm water the Weasel can attain an approximate speed of 4 mph.

The amphibious Weasel, officially designated M-29C, has an overall length of 192 in., an overall width of 67 in., ground clearance of 10½ in. and a weight, without crew or cargo, of 4,771 lb. The watertight bow and stern compartments are bolted to the hull proper and may be removed at will. A capstan and a headlight are affixed to the bow as well as a rigidly attached towing eye. The capstan is located on the deck of the bow cell and is driven by a power take-off from the front of the engine. The stern has a pintle hook for towing and fittings to hold such tools as an axe and a shovel.

The first experimental M-29C was tested in the tidal mud off Long Island. Experts were agreed that tidal mud was one of the most formidable obstacles that any amphibian would have to contend with, but viscous, heavy mud was nothing to the Weasel. Later it was tested with equal success in the Louisiana bayous. Apparently, there is nothing on earth or under sea that can stop the Weasel from carrying out a mission—if there is, it simply has not yet been discovered.

Assembly-Line Production

At present the Weasel is being turned out in quantities on an automobile assembly line. The all-welded steel hulls, bows and sterns are fabricated in Studebaker body shops, while engine, bogie and drive wheels, tracks and other chassis parts are installed on a moving assembly line. Swimming abilities of the completed Weasel are tested in a large tank, and it is then taken for a hair-raising test run at top speed around corners and over steep railway embankments.

Hull Construction

The Weasel body, including bow and stern, is an all-welded job, and all of the three basic welding processes are employed in its fabrication. Body manufacture consists of one main, three major subassemblies. The main hull assembly begins with the "keel," a long, narrow bottom frame made up of welded mild-steel sheets and formed channels (Fig. 2). This keel moves down a production line on a long series of jigs. Quick-acting clamps (Fig. 3) facilitate the transfer of the assembly from jig to jig.

At a fairly early stage in manufacture, front and rear axle housings are attached by spot welding them to the keel with portable welding guns. Cross braces and supports for the four transverse springs suspending the bogie wheels are installed by arc welding. After a number of machining operations such as drilling and tapping have been performed, the two bottom-panel and side-panel assemblies are gun welded, and the final hull contour begins to appear. Front panel, bulkhead, rear panel, front top plates and coaming follow in rapid succession; the spot-welded seams are made watertight, and the hull is ready for testing. The three major subassemblies—track apron, bow and stern—are then added to complete the

body of the amphibious Weasel.

Basic fabrication of the Weasel body is by spot welding. The steel sheets are welded to each other and to reinforcements and fittings by means of welding guns supported on a monorail. These guns are for the most part manually operated, the duration of the welds being determined solely by the operator's good judgement. This procedure would not work with aluminum sheet, but it is entirely satisfactory with the easily welded mild-steel sheets. The spots are placed an inch or so apart and are made one after another in rapid succession, the operator depressing a button with his thumb when he has brought the electrode into proper contact. The strength of each assembly is derived basically from these spot-welded seams.

Arc and Gas Welding

The spot-welded seams are not watertight, and they must be made so if the vehicle is able to float. This is done by means of both arc and gas welding. Arc welding (Fig. 3) is used wherever possible because of its greater speed and lesser distortion. It is by no means easy to arc weld thin-gauge sheet, however, and welders must be specially trained for this purpose. Only highly skilled craftsmen can be employed for the difficult operation of sealing. Heavily coated, all-position electrodes of the AWS E-6012 class are used in sizes of $\frac{3}{32}$, $\frac{1}{8}$ and $\frac{5}{32}$ in. Where minimum slag is desirable, lightly dusted electrodes are used.

Oxy-acetylene welding is used wherever there is danger of burning through the thin sheets with the metal-arc process. The welding torch is used with filler rod to fill in unfinished corners and plug small holes and without filler rod to fuse together the edges of lapped sheets. Because of the necessity of securing fast heating, an oxidizing flame is generally used. Some experiments have been conducted with the carbon arc, but it has not been found possible to use this process to replace gas welding.

Testing for Leaks

The completed hull undergoes two tests for watertightness. First it is inverted and tested by air pressure and a soap solution. Two oxy-acetylene weldors quickly repair all the leaky seams thus discovered. The next test is by submersion in water. The hull is picked up by crane and attached to a heavy cradle known in the shop as the "dunker." It weighs 3,900 lb—a weight necessary to overcome the natural buoyancy of the hull in the water tank. The cradle is of welded construction and so is the large steel tank into which it fits. The water testing of the hull should not be confused with the similar test of the completed vehicle (in a much larger tank) previously referred to.

With the hull firmly affixed, the "dunker" is picked up by four hooks, entering eyes at each corner, and dipped in the tank (Fig. 4). Its heavy weight drops the hull at once to the bottom, and two workers climb inside, each holding a lamp on a long extension cord. They make a thorough visual inspection of each seam, carefully noting the source of each leak with a crayon mark. The hull is then hoisted from the water tank to free the "dunker" to test the next hull. Defective seams are repaired by oxy-acetylene welding (Fig. 5).

The bows and sterns of the amphibious Weasel are manufactured in a separate shop in a separate building. Like the hull, these two compartments are fabricated from steel sheets, and the process of manufacture is similar, though there are not so many operations involved.

Stern Assembly

The stern assembly consists of lower side panels, lower rear panel, upper side panels, front panel, pintle-hook tube assembly and top panel. The sheets are formed, flanged and carried to a jig for the addition of tapping plates and a strainer (stiffener). The assembly is then rapidly stitched together with portable welding guns (Fig. 6). The stern sections are carried to welding booths where all seams which will be below the water line when the Weasel is immersed are sealed by arc and gas welding. Other arc weldors prepare the pintle-hook assembly, an arc-welded unit of three tubes and two plates, and weld it into place inside the stern compartment. Fittings to hold the axe and shovel are then spot welded to the top deck.

Like the hull, the stern is tested for leakage with both air and water.

Bow Assembly

The bow is similarly formed. Its components include side panels, front panel, lower outer panel, tow-plate brace assembly, rear panel, shelf panel, shelf and brace assembly and top panel. Spot welding is used to stitch the formed sheets into place and for the addition of reinforcements and fittings such as the towing eye. After the seams below the top have been sealed by arc welding outside and inside, the top deck is gun welded into place. The top seams do not have to be sealed as they will always be above the water line. The unit is air and water tested immediately after the top panel has been gun welded.

Hull, bow and stern are all equipped with tapping plates which will permit the three units to be assembled by bolting them together. All joints on the Weasel body which cannot be sealed by welding are rendered leakproof with bitumastic sealing compound.

Fig. 6—This is the first operation on the stern compartment. Upper and lower side panels are being gun welded to the rear panel.

Flash Welding Rings

American Welding Co. specializes in the fabrication of steel rings and bands, flash-butt welded on controlled welders. With over a quarter of a century's experience, the company has developed many interesting techniques to insure customers fast production and high quality.

By **DR. I. A. OEHLER and ROBERT E. GOODMAN**
Dept. of Metallurgy and Research, The American Welding & Mfg. Co., Warren, O.

AMERICAN WELDING has specialized in the fabrication of steel rings, bands and welded ring assemblies for well over a quarter of a century. In 1918 this company started operations with eight people, producing steel wheel bands for army truck and field artillery wheels. Today plant and payroll have expanded to over 100 times the size of that small beginning. In the present war effort, we have been producing parts for tanks and tank destroyers; motor and generator frames; bands; gear, angle, channel and flange rings and dozens of other vitally needed parts not circular in form.

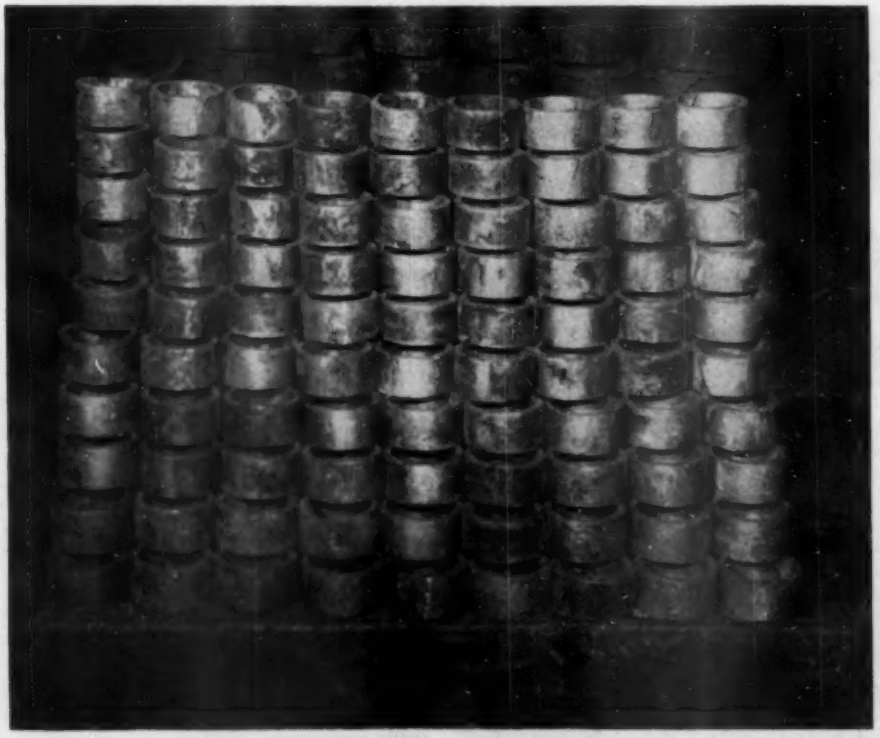
Rings are formed from bar or plate stock or from special rolled sections, and the ends are joined by flash-butt welding. We form, weld, size, machine, flame-harden and furnace heat treat rings and bands as individual pieces. We also build up assemblies of rings and other parts by manual and automatic arc welding. Though we do other work, such as the flash welding of forgings to tubing for aircraft applications, the bulk of our business is and has always been concerned with the manufacture of circular weldments.

From 4 in. to 8 ft.

A ring or band has three dimensions: face or width, inside diameter and thickness. We manufacture, as standard sizes, rings with thicknesses ranging from ⅛ to 3 in., widths from ¼ to 20 in. and inside diameters from 4 in. to 8 ft. Fig. 1 shows a typical order of small rings. At the opposite end of the scale are the 8 ft ID rings we manufacture for army tank turrets.

Welded rings and bands have a surprisingly extensive application throughout industry, especially in the machine tool and heavy equipment industries and in the automotive, aircraft, railroad and farm implement fields. A few specific applications are: rings for motor, generator, brake and clutch frames; flanged rings for large piping installations; reinforcing rings of various types; gear blanks; tank turret rings; ball, roller and tapered bearing races; arc bars and manhole rings for marine boilers; magnet frames; wheel bases and gear rings for industrial trucks, tractors, etc.

Fig. 1—An order of small flash-welded rings. American Welding makes all sizes of rings from 4 in. to 8 ft in diameter.



Flash-Butt Welding

We employ the flash welding or flash-butt welding process extensively to join the ends of steel rings and bands. After forming, the pieces to be welded are placed in an electric circuit in such manner that a multitude of fine arcs or "flashes" will occur and heat the surfaces to be joined. When the proper plastic temperature has been reached, the pieces are forced together to forge the joint under high pressure.

A flash weld is a pressure weld, distinct from a fusion weld. It is made without the addition of any filler metal and is similar in some respects to the old fashioned forge weld made by blacksmiths. The blacksmith, too, would heat the pieces to be joined to plastic welding temperature, though of course he used a forge fire instead of rapidly recurring short circuits of high electrical currents.

The smith would carry the heated parts to his anvil and forge the ends together by a rapid succession of blows with a heavy hammer. Just such a forged weld is made in flash-butt welding. Instead of a hammer, however, the forging is accomplished by the mechanical or hydraulic application of pressure.

The blacksmith's welds were of high quality when properly made, but the problems of uniform heating and fluxing were always present, and his welding operations were confined entirely to mild and medium carbon steels. Living in a less scientific age, he lacked the control on his processing and the knowledge of such factors as

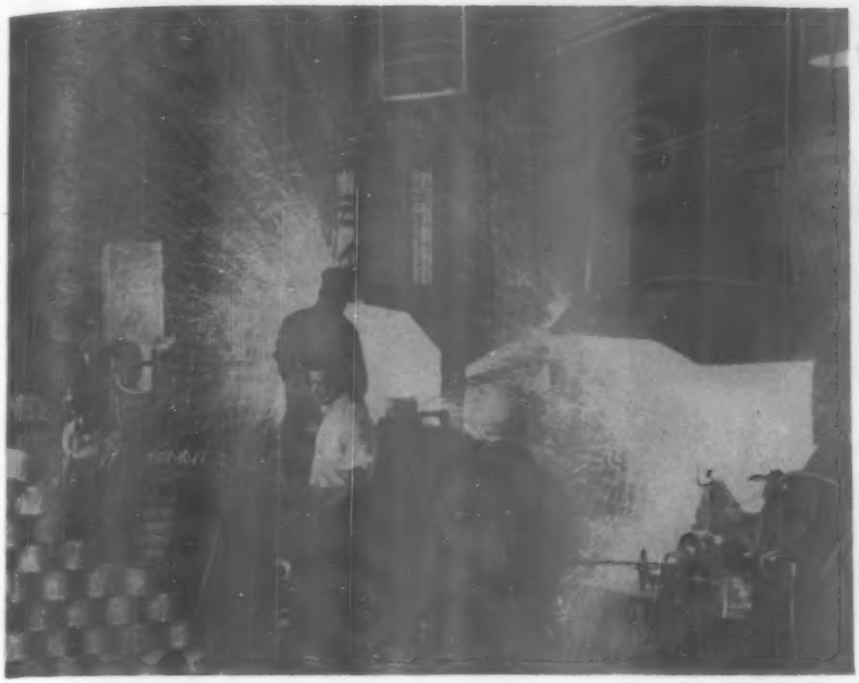


Fig. 2—Flash welding small rings. The rings are bent with flattened ends to fit the dies of the flash welder.

hardenability and low melting points of high-carbon alloy steels, which are so necessary in the production of sound welds on all grades of steel. The flash-butt welding process is able to overcome these and other problems because of its much greater flexibility and far more precise control.

The amount of current being delivered at any instant, the duration of flashing, upset and postheating periods, the speed with which the dies come together, the amount of hydraulic or mechanical pressure being exerted—all of these can be very closely regulated. The result is that it is possible to flash weld any alloy steel as well as many non-ferrous materials and produce welds that are cleaner, stronger and more consistent than those made by any other welding process. Using flash welding, for example, we are able to form and weld rings of ingot iron, mild steel, high carbon steel, all alloy constructional steel including SAE 52100 for bearing races, stainless and heat-resisting alloys, Monel, aluminum and other metals.

Advantages and Equipment

If properly made, a flash weld has the same physical properties as the parent metal. It also has the same electrical and magnetic properties, highly important in the case of certain electric motor and generator frames. Other good reasons for the use of flash welded rings are:

1. Flash-butt welding forges the joint, eliminating any loss of strength. Stress can be figured at 100% of the parent metal.

2. The surfaces to be joined are protected from oxidation by the flashing action and by the layer of molten metal which is expelled under upset pressure. This insures a perfect weld.

3. Parts can be fabricated to close tolerances. We can hold the tolerances on straight pieces to plus or minus 0.010 in. Ring tolerances, of course, vary with the diameter of the ring but much greater accuracy can be maintained in formed and welded rings than is generally possible with either forgings or castings. Machining time is saved by holding rough dimensions close to the finished size.

4. The welding process is rapid, consuming a minimum of production time.

5. Flash welds may be heat treated to meet the same physicals as the parent metal.

6. Special sections can be tailor-made to effect additional machining savings or for special applications.

Our equipment for flash welding includes several welders of from 100 to 750 kva capacity, all specially designed for ring work. Most of these machines are fully automatic, having cam-operated limit switches and controls which can be automatically timed for desired preheat, flash, upset, and postheat periods. The manually operated welders are equipped with indicating devices to signal the operators at prescribed times.

Fig. 3—The welded ring is heated and stretched to roundness and size on a hydraulic expander. This machine is one of many in the American Welding plant. The primary purpose of the expander is to make the ring round, but it also serves to insure that the weld is just as sound as the parent metal.

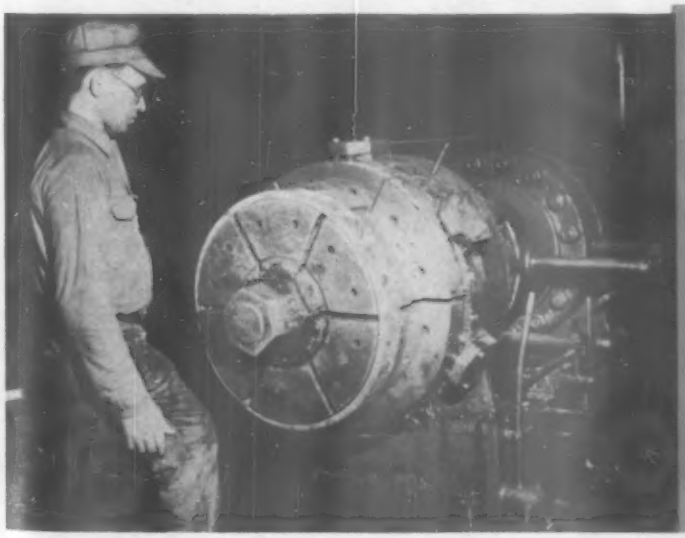


Fig. 4—The opposite of the expander is the shrinker, which is used when the OD dimension of the ring is more important than its ID. The segments are forced together by hydraulic pressure to squeeze the hot ring into proper size and roundness.

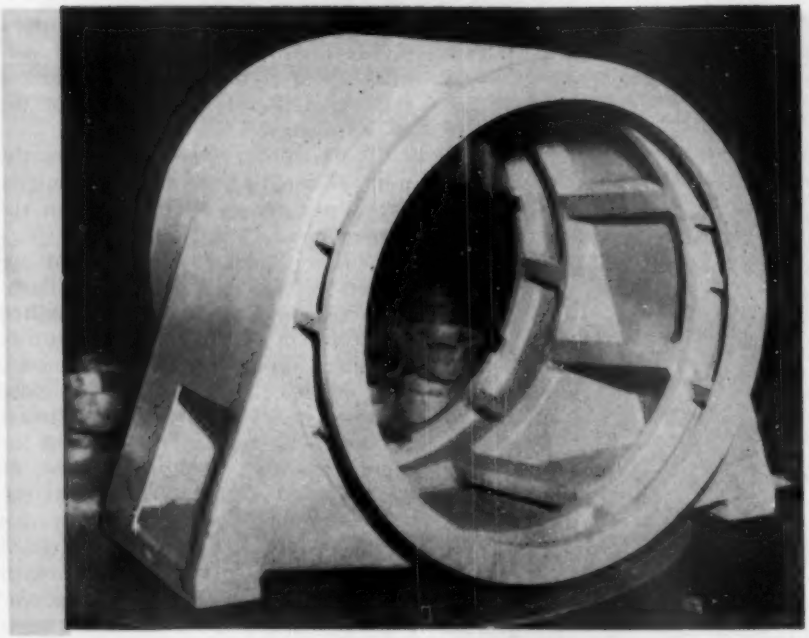


Fig. 5—An a-c motor frame. This particular unit contains 27 parts, including four flash-welded end rings

Fig. 6—Arc welding a lug to a small flash-welded ring.

Ring Fabrication

Rings usually begin with flat bar or plate stock; if necessary, however, we can form complete rings of shapes such as tees, channels or angles or form specially rolled sections. The stock is rounded on a three roll former and flattened into a D-shaped piece with flat ends that will fit the dies of the flash welder. Rings with very large diameters such as the 8 ft tank turret rings can be and are formed and welded round because the comparatively small segments which will engage the dies have so small a curvature as to be almost flat. Such, however, is not the case with small or medium-sized rings. The ends of the formed piece are ground to insure good electrical contact with the dies, and the part is ready for flash welding as shown in Fig. 2.

The flash welding of a ring offers one peculiar electrical problem. Owing to the nature of the ring, a considerable amount of the current is short circuited around the ring and contributes nothing to the actual welding. Since this short circuit current makes up approximately 60 to 80% of the total load, a large consumption of current is necessary.

The welding period ranges from a ten second cycle in the case of small rings (not over ¼ in. in face and thickness) to a forty second cycle for large tank turret rings. In the ten second cycle, fully 9¾ seconds are required for flashing and only ¼ second for upset. In the forty second cycle, approximately 36 seconds are used for flashing (including preheating), 2 seconds for upset and 2 seconds for postweld heating in which the current is allowed to flow after completion of the weld.

Shrinking and Expanding

The upset metal at the joint is chipped with a pneumatic hammer, and the ring is ready for final sizing. It is worked hot or cold depending upon size or material limitations. If it is desired to hold the ID closely, the ring is expanded from within. If the OD must be held, the ring is shrunk from without.

The machines for performing these two operations are quite similar in that each consists of a number of circular segments which are manipulated to engage the circumference of the ring. When the machine engages the inside circumference and stretches the ring, the machine is called an

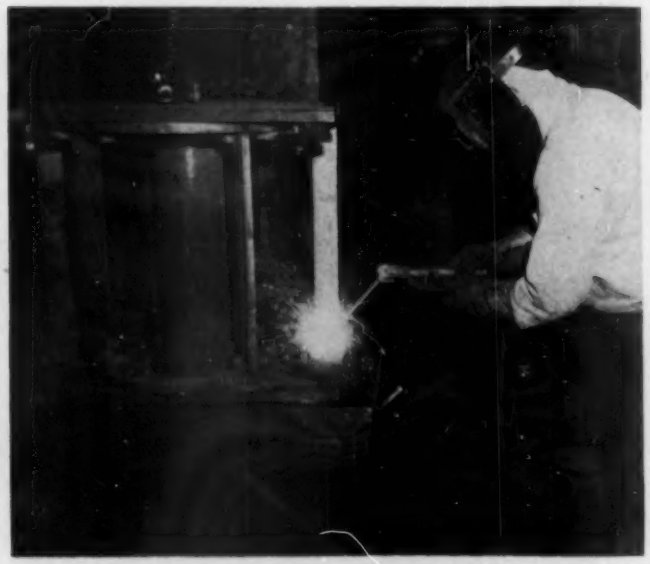


Fig. 7—Arc welding spacers to end rings in the fabrication of an a-c motor frame.

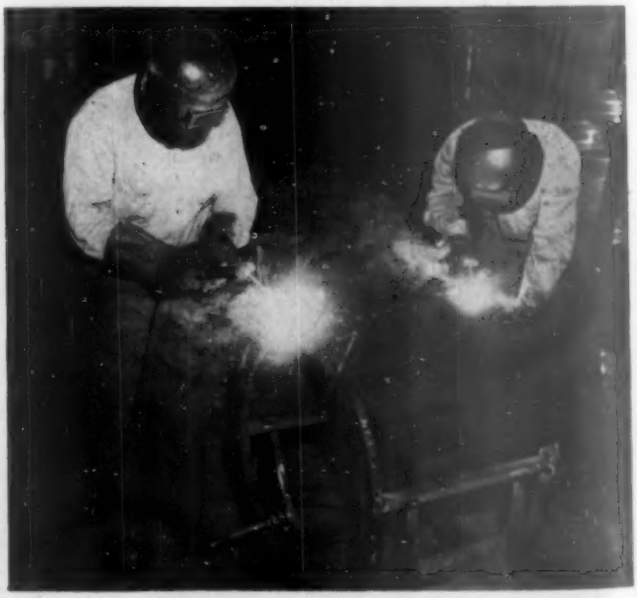


Fig. 8—Arc tacking a wrapper of sheet metal to the a-c motor frame.

expander. When the outside circumference is engaged and the circumference shrunk to size, the machine is called a shrinker. Movement of all of the segments is controlled by a single operating lever so that all segments work at the same distance from the center, thereby insuring nearly true circularity upon completion of the operation. In fabricating rings, the rounding operation stretches the material at the weld some 10 to 15% —an extremely good test of weld quality. While the primary purpose of the sizing operation is to make the ring round, it also serves to insure weld soundness.

After sizing, the ring may or may not be flattened under a hydraulic press. This operation is generally necessary on rings of relatively small face or width dimensions. Sized, and flattened, the ring is ready for: (1) assembly with other parts, (2) shipment in its existing form or (3) subsequent machining. A battery of special vertical lathes and boring mills, together with other machining tools, is maintained to turn, bore, drill, tap, etc.

Complete furnace heat treating and flame-hardening facilities are maintained. Circular shapes lend themselves readily to flame-hardening, and much of this work is done in our shop.

The final step is, of course, inspection. Rigid inspection is combined with close production control in order to assure quality products. The metallurgical laboratory makes microscopic examinations of weld structures in order to establish and to check production procedures. The magnetic-particle method of inspection is used on all parts requiring this type of control as well as for spot checking of all welding processes. Our inspection department leaves no stone unturned in its constant endeavor to insure strict conformance of all products to their specifications.

Fabrication of Motor Frames

We are equipped to turn out all types of welded ring assemblies, building complex units from flash-welded rings by means of arc and gas welding. Electric motor frames provide two very good examples of such ring assemblies. We make frames for both a-c and d-c motors with ratings of from ¼ to 50 hp.

A typical a-c motor frame is shown in Fig. 5. This unit has 27 pieces, including four flash-butt welded rings. To these are arc welded the necessary lugs (Fig. 6) and spacers (Fig. 7), also the feet and other parts. The final step in assembly is to arc tack a cover or wrapper plate of comparatively thin sheet material about the frame as shown in Fig. 8.

The 30 hp a-c motor frame shown in Fig. 5 is fabricated by arc welding spacers and wrapper plate to flash-welded rings of approximately 25½ in. diameter. The arc welding is performed by positioning the material in jigs, close attention being paid to fit-up. Welding is done on an a-c welder, using ¼ to $\frac{5}{16}$ electrodes with current varying between 250 to 325 amp. The light-gauge wrapper is welded with $\frac{3}{16}$ electrodes at approximately 125 amp.

The entire assembly is stress relieved in a furnace by heating it slowly to 1,200 F and furnace cooling it to approximately 600 F before air cooling.

D-C Motor Frames

The d-c motor frame is an entirely different type of assembly as may be seen by comparing Fig. 5 with Fig. 9. Frames for d-c motors and generators for aircraft have been made out of forgings and heavy-walled seamless tubing, but we showed that they could be made better and cheaper from flash-welded rings formed from bar stock. Since the steel frame plays a part in the magnetic circuit, the quality of the weld is of the utmost importance.

Unlike an arc weld, the flash weld has the same magnetic properties as the parent metal. Flash-welded rings are superior to forgings and tubing because of the magnetic advantage of circumferential grain flow — an advantage which can not be obtained with any other manufacturing method.

The d-c generator frame shown in Fig. 9 is used on railroad cars. This frame is built up by arc welding seven flash-welded rings together. The heavy center sections are the field yokes, and are of an analysis chosen to meet the required magnetic properties. The slots or hand holes are torch cut. Arc welding is done with alternating current using $\frac{5}{16}$ diameter electrodes at approximately 300 amp. Jigs are used to position the rings. The fabricated frame is furnace annealed by heating it to 1,550 F and cooling very slowly to insure maximum permeability in the magnetic yoke.

Fig. 9—Frame for a d-c railroad car generator. Seven flash-welded rings were assembled by arc welding to make this piece. The heavy construction is typical of d-c motor frames, which are quite different from a-c motor frames (see the one shown in Fig. 5).

War-Wearies Rejuvenated

"Monkey-gland" transfusions for war-weary and battle-scarred aircraft are given at the welding unit of Air Technical Service Command. Welding also helps to make modifications to comply with specification changes.

WELDORS working on war-weary aircraft in AAF depots throughout the country are developing new skills and calling on all the old ones to help recondition these wounded warbirds. Virtually all welding processes are being employed.

Heliarc Welding Experiments

Typical of the work they are doing is that at Air Technical Service Command, Fairfield, O. A new application of the Heliarc welding process, for instance, is now being developed; experiments in progress on critical engine parts will, if successful, effect savings in both time and money.

Another time-and-metal-saving procedure developed at the depot is for reclaiming damaged engine cylinders by aluminum arc welding. This procedure is also being used in combat areas.

Fairfield ATSC is one of a dozen huge supply and maintenance centers operated by Air Technical Service Command. It is located only a few miles from Wright Field, world headquarters of ATSC.

Assembly-Line Repairs

Battle-damaged planes which come to the depot for repair—some of them veterans of many bombing missions—move in line through a huge workshop as, step by step, they are dismantled and then expertly rebuilt. One important stop along the route back to Osaka or Tokyo is the welding unit, where skilled workers, about 20% of whom are women, wield modern techniques to counteract the damage done by enemy bullets or the stress of combat service.

Before the welding unit accepts any damaged part, an inspector examines it to make sure that it is repairable. Final inspection after repairs have been made assures the fitness of the piece for service on the fighting fronts.

Sometimes the weldors completely rebuild small parts, such as cowling lugs that have broken off engine cylinders; frequently their job is to make modifications in compliance with changes in AAF technical orders. Occasionally the facilities of the welding shop have been utilized for the manufacture of aircraft parts manufacturers were unable to supply.

Aluminum Arc Process

To repair exhaust port stud holes by the new aluminum arc process, the damaged cylinder is first set on a milling machine and all threads removed with a ½ in. ball end mill. The opening is milled out from inside port to stud hole until the aperture is approximately ¾ to ⅞ in. wide at the top, tapering to approximately ½ in. at the bottom. The surrounding area is then machined in order to remove all of the remaining threads and sharp corners.

Cooling fins adjacent to the stud hole are covered with sheet metal or asbestos, while the area around the hole is preheated with the oxy-acetylene flame to 500 or 600 F. The arc-welding machine with the polarity reversed is set at 125 amp, and a layer of metal is deposited with a ⅛ in. coated rod. The flux is chipped off, and the hole is built up by additional passes until sufficient metal has been deposited to permit the port face to be machined to its original dimensions. The welded cylinder is covered with sheet asbestos and cooled slowly. The holes are then re-drilled and tapped to size.

The same method is also being employed at the depot to repair broken cooling fins. Heat used in the process has no adverse effects upon the cylinder barrel.

Resistance (spot) welding is used for reinforcement patching of aluminum and stainless-steel engine cowlings, wing fairings, ammunition boxes and the ammunition chute assemblies which feed shells into machine guns. Life raft doors, inspection doors, and pilot-seat assemblies are other typical parts which are repaired by this method. This type of resistance welding can be done only by highly skilled operators with a wide knowledge of metals.

Atomic-hydrogen welding is used to seal up leaks in oil tanks, to rebuild cowling lugs on engine cylinders, to repair carburetor bodies, to repair breather pipe assemblies and other similar parts.

Engine Primer Lines

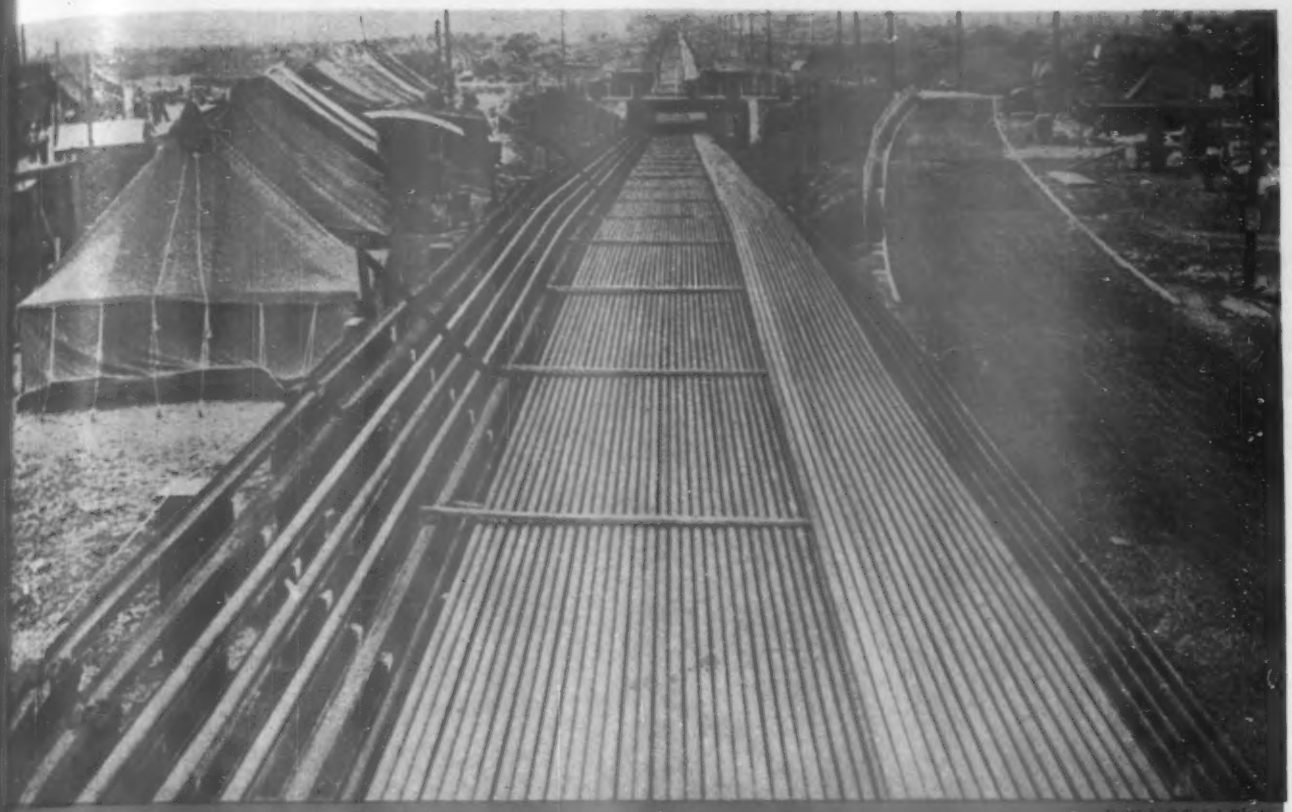
Silver brazing by the oxy-acetylene method is used for such jobs as repairing ignition harness rings and stainless-steel primer lines. The accompanying picture shows the time-saving fixture designed to locate primer lines for brazing. This fixture can be adjusted to suit the many lengths of lines in use. Before it was built, the lines had to be handled one at a time.

An example of the versatility required at ATSC is provided by modifications recently made on exhaust collector assemblies of the B-17 to comply with changes in technical orders. This one job required the use of oxy-acetylene, resistance and arc welding.

Trained technicians in the welding unit also re-align war-wearies, checking on wings, fuselage and all tail surfaces.

This time-saving production method of installing new cone assemblies on stainless-steel engine primer lines is used in the welding unit, Air Technical Service Command, Fairfield, O. The lines are located in the adjustable fixture for silver brazing with the gas torch.

Air Technical Service Command Photo



British Official Photo

Hamel pipe stored in ¼ mile lengths ready for winding on the "Conundrum," the huge swaying bobbins which laid the pipe by rolling it off as they were towed across the Channel. About 300 miles of pipe can be seen in this picture.

Pipe Lines for "Pluto"

British engineers display noteworthy ingenuity in the design of "Hais" cable and "Hamel" welded steel pipe for Operation Pluto—Pipe Lines under the Ocean. The Royal Navy took the job of laying the Channel lines.

From August 12, 1944, to May 8, 1945, about 120,000,000 gallons of gasoline reached the Anglo-American Armies in Europe via the pipe-line system laid under the English Channel by British engineers in coöperation with the British Navy. There are altogether a total of 20 undersea pipe lines, of which 16 run from the southeast coast of England to Boulogne and four from the Isle of Wight to Cherbourg. This vast engineering feat was christened "Operation Pluto," meaning "Pipe Line under the Ocean" and having no reference to the ruler of Hades. The special piping utilized and the methods of laying it were evolved by experts from the oil fields. Welding permitted the piping to be joined into a single continuous length.

Hais: Hollow Cable

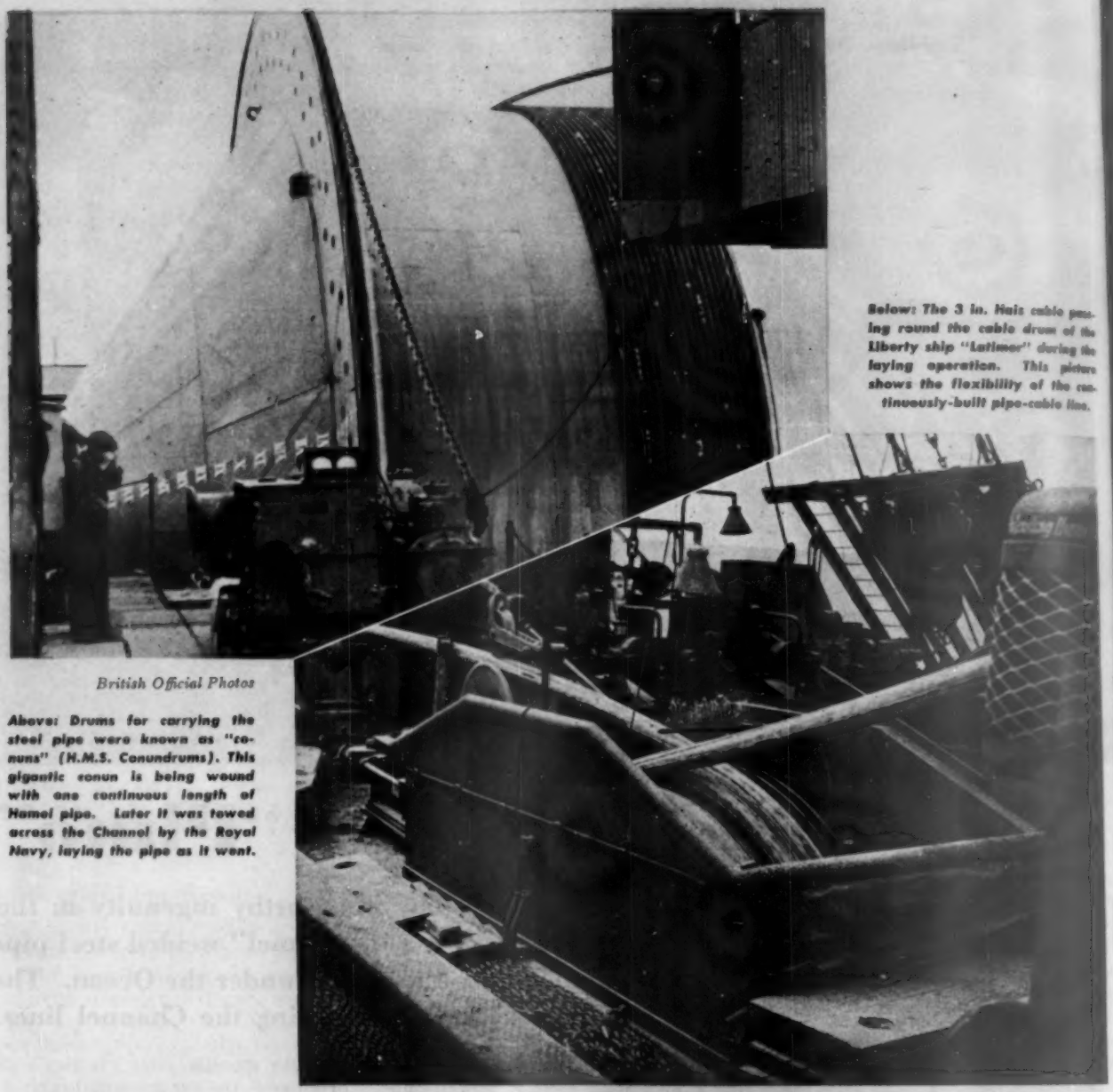
With the exception of 140 miles of cable manufactured in the United States, the Channel pipe-line system was a purely British operation in plan and execution. The first practical suggestion came from A. C. Hartley, chief engineer of the Anglo-Iranian Oil Co., who had used 3 in. high-pressure pipe lines in Persia. His idea was to use a 2 in. hollow cable, something like a submarine electric power cable but without cores and insulation, which could be laid across the Channel in a few hours from cable-laying ships.

By working day and night over two weekends, technicians of the firm of Siemens and Henleys completed the full-scale order for several hundred yards of this cable. It was laid in the Thames from a cable-ship loaned by the British Post Office, and the results were so successful that Prime Minister Churchill gave the scheme his blessing. Two 30 mile lengths of cable were ordered to permit full-scale trials to be held in Bristol Channel, where the currents and other conditions approximate most closely to those found in the English Channel. It was also decided to increase the diameter to 3 in. and to strengthen the cable for working pressures in excess of 1,200 psi.

Eight months after Hartley's idea originated, the experimental cable was laid in Bristol Channel by H.M.S. *Holdfast*, a coaster which had been fitted with gear for transporting this unusually heavy cable. The fact that the cable was hollow increased the difficulties since it was liable to kink and so stop the oil flow. The cable was therefore laid full of water, which kept it inflated. This pipe line was called the Hais (Hartley-Anglo-Iranian-Siemens).

Hamel: Welded Steel Pipe

Meanwhile another kind of pipe line was invented by B. J. Ellis, chief oil fields engineer of the Burma Oil Co., and H. A. Hammick, chief engineer of the Iraq Petroleum Co. This second pipe line, named "Hamel," was composed of 20 ft lengths of 3 in. diam steel pipe which could be welded automatically into any length. This pipe could also be wound onto a drum



British Official Photos

Below: The 3 in. Hais cable passing round the cable drum of the Liberty ship "Latimer" during the laying operation. This picture shows the flexibility of the continuously-built pipe-cable line.

Above: Drums for carrying the steel pipe were known as "conuns" (H.M.S. Conundrums). This gigantic conun is being wound with one continuous length of Hamel pipe. Later it was towed across the Channel by the Royal Navy, laying the pipe as it went.

like thread on a spool if the drum were 30 ft or more in diameter. To provide such a drum, the Admiralty's Director of Naval Construction designed H.M.S. *Persephone*, converted from a hopper barge to a craft with a great wheel rotating in trunnions on her deck. From this a second idea developed—a floating drum which could be towed by tugs. It would be capable of carrying the full length of pipe required for the Channel crossing and would pay off the pipe like a large bobbin as it was towed toward France.

Within a few months a special factory at Tilbury, in the Thames Estuary, was equipped for welding the 20 ft lengths of Hamel pipe into 4,000 ft lengths at a rate of ten miles daily. Storage facilities were able to care for a total of 350 miles of pipe a day. A duplicate factory was established shortly afterwards in case the first should be bombed.

The floating drums, called H.M.S. *Conundrums* ("conuns" for short), were moored in deep water at the end of the pipe racks so that the 4,000 ft lengths might be welded into a continuous length of 30 or more miles and wound on to the conuns while they rotated. A conun is 90 ft long, over 50 ft in overall diameter and when fully wound weighs 1,600 tons —the weight of a destroyer. It can carry up to 70 miles of piping. The drum around which the pipe is wound is 40 ft in diameter and 60 ft long.

Force Pluto

After the successful trials of the Hais cable in April, 1943, Geoffrey Lloyd, British Minister of Petroleum Welfare, arranged that the manufacture of Hais cable and Hamel pipe and the coördination of the whole scheme, together with provisions for pumping stations on the English shore, should be the responsibility of Britain's Petroleum Warfare Department. The Royal Navy accepted the responsibility of laying the pipes at sea. Accordingly, Force Pluto was formed under Captain J. C. Hutchings of the Royal Navy. Composed of ships of all sizes from 10,000 tonners down to barges and motorboats, the Force was placed under the command of Admiral Sir Bertram Ramsey, Allied Naval Commander.

Force Pluto's main base was Southampton, England, with a secondary

British Official Photo

British troops installing a T-union valve at Boulogne for the first pipe line in October, 1944. Boulogne was entered on September 22, and the laying of the pipe lines from Dungeness began immediately.

Below: By means of the pipe-line network in Britain, gasoline can be pumped from Liverpool straight through to areas east of the Rhine. Here the lines are seen emerging from a camouflaged gasoline storage tank.

British Official Photo

base at Tilbury. The Force numbered 100 British Merchant Navy officers and 1,000 men. In addition to H.M.S. *Holdfast*, three merchantmen were fitted with the cable-laying machinery. Two could carry 100 miles and one, 30 miles of Hais cable. Thames barges were converted for handling the cable at the shore ends.

Six conuns handled the Hamel pipe. New pipe lines were run from the British system to take the gasoline to the coast, and special high pressure pumping stations were cleverly camouflaged. One of these was in a row of blitzed houses at Sandown on the Isle of Wight; another was in an old fort built in the 1860's against possible invasion by Napoleon III, and others were in a modern amusement park and in seaside villas at Dungeness—30 miles from Boulogne.

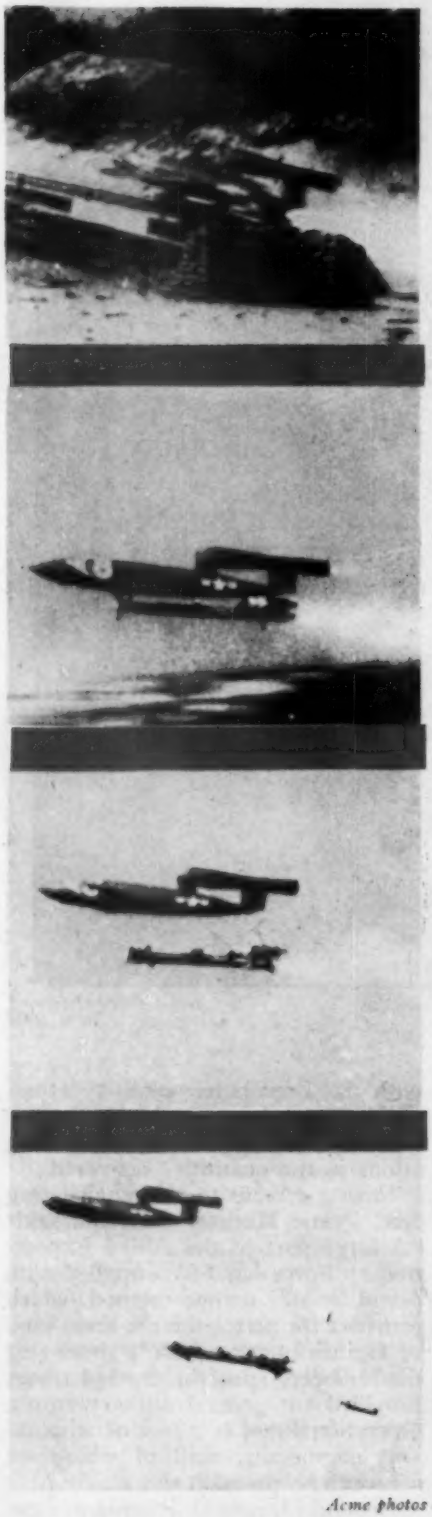
"Operation Pluto" began as soon as mines had been swept to the approaches to the tip of Cherbourg Peninsula. The 70 mile lines from the Isle of Wight to Cherbourg took ten hours to lay and conveyed gasoline to the United States armies. The lines from Dungeness to Boulogne, established as soon as Boulogne was captured, took five hours to lay and transported gasoline to the British 21st Army Group. Men of the Royal Army Service Corps pumped oil to cleverly concealed pumping stations on the French coast, frequently in rough weather, having to wade up to their necks to bring in the end of the line from the ships. An R.A.S.C. petroleum unit maintained direct contact with the French terminals by cross-Channel wireless telephone, thereby instantly detecting and reporting variations in the quantities delivered.

Paying tribute to this engineering feat, Prime Minister Churchill said: "A large part of the Allied Expeditionary Force has been supplied with petrol by this unique method, which provides for petroleum the same kind of facilities upon a hostile shore that the Mulberry (prefabricated) harbors provided for general military stores. Operation Pluto is a feat of amphibious engineering skill of which we may well be proud."

General Dwight D. Eisenhower expressed his "warm appreciation" of the work done by the Pluto pipe lines in supplying United States as well as British forces.

★ PRODUCTION

America's Answer--the JB-2



Acme photos

Fig. 1—Taken at a United States Air Force experimental station, these pictures show the new American-made buzz bomb being launched. The rocket carrier drops away as the bomb engine takes up the burden of continuing the flight.

Buzz bombs being built in America will be used in the not-too-distant future to shorten the bitter battle with Nippon. The Nazi V-1 was an excellent product, but the all-welded engine of the JB-2 is even better.

By **T. B. JEFFERSON**

Less than eight months after V-1 bombs had begun to rain on England, the United States Army had developed and was in active production on a similar bomb to use against the enemy. Had VE day not come in May, our robot bombs would undoubtedly have been falling on Berlin long before this. But the efforts and expenses of this project are by no means wasted as the Japs will soon learn.

Ford and Willys Share Job

The Ford Motor Co. is making the engines to power American robot bombs—as yet purely for test purposes. However, the intermittent impulse duct engines driving the JB-2—American version of the Nazi V-1—have been built on a production-line basis at Ford's Rouge plant for the past nine months. These engines are tested and delivered to the Army Air Force for installation on the bomb fuselages (shown in flight in Fig. 1).

With the exception of engines and controls, Willys-Overland Motors makes the bombs, which are similar to the Nazi robot bombs already described in The Welding Engineer (January, 1945 issue, page 45). To date, our completed robots have been flown only for test purposes. It is interesting to note, however, that the quantities produced have been far in excess of the number that would normally be required for tests.

Jet Impulse Engine

The engine manufactured by Ford is a streamlined tube about 11 ft long that is built in four sections. The tube is 21 in. in diameter at its forward end, in which is set a grid section with spring steel flappers. These open to admit inrushing air and close for the explosions. The fuel jets are mounted in this grid.

The rear of the tubular engine is simply a 15 in. diam open vent, from which the expanded flaming gases

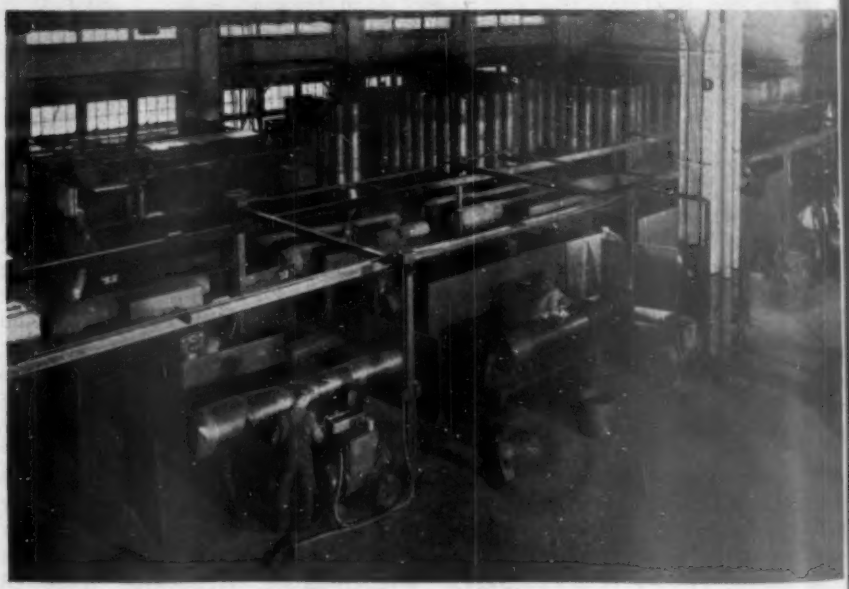


Fig. 2—Fabrication department for robot bomb engines at the Rouge plant of the Ford Motor Co. The engine shell consists of four tubular sections, assembled by welding.

Allis-Chalmers Electrodes Have Got To Be Good!

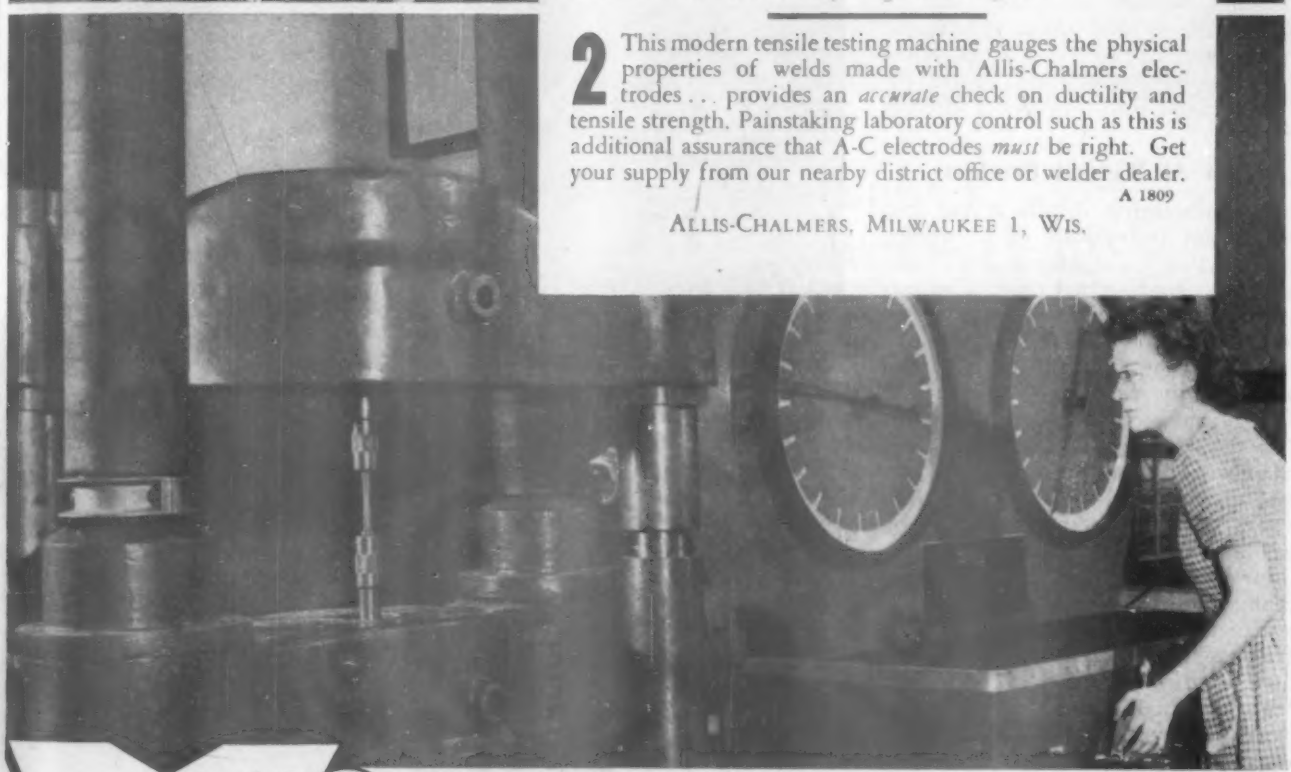
BECAUSE: 1) We use tons of them every day *ourselves* . . . 2) We constantly test weld metal by X-Ray, tensile machine, metallographic microscope — to assure continual high quality of electrodes.

1 Being one of the world's largest *users* of welding equipment, we are able to *production-prove* our electrodes in our own Allis-Chalmers shops—under every type of welding condition. Large welding jobs such as this heavy compressor cylinder are everyday routine. Successful welding of this work *depends* on the quality of Allis-Chalmers electrodes. They've *got* to be good!

2 This modern tensile testing machine gauges the physical properties of welds made with Allis-Chalmers electrodes . . . provides an *accurate* check on ductility and tensile strength. Painstaking laboratory control such as this is additional assurance that A-C electrodes *must* be right. Get your supply from our nearby district office or welder dealer.

A 1809

ALLIS-CHALMERS, MILWAUKEE 1, WIS.



A-C Electrodes
EASY TO REMEMBER
EASY TO BUY
Sold by AWS Number

HEADQUARTERS FOR WELDING EQUIPMENT

AMPAC A-C WELDERS

WELD-O-TRON D-C WELDERS

ARC WELDING ACCESSORIES

Fig. 3—Assembling the fuel-metering device, which might be likened to the carburetor of the ordinary internal-combustion engine. Both silver-brazed joints and spot welds are required to tack this complex assembly together.

flow in a series of intermittent explosions. These reaction forces develop about 2 hp for each 1 lb of the 300 lb engine. Despite its high horsepower per pound rating, the engine is not considered to be any too efficient. It will use 415 to 430 gallons of gasoline per hour while driving the bomb through the air at speeds varying from 250 to 300 mph. Its thrust horsepower of about 600 is equivalent to brake horsepower of 750 for the conventional piston-propeller driving engine.

An All-Welded Product

Manufacturing details reveal that the engine is basically of all-welded construction. The engine shell consists of a four-section tube. The sections are fabricated from hot-rolled low-carbon steel strip of various thicknesses (from 22 to 12 gauge) and subsequently welded together.

The four sections (see Fig. 2) are: (1) the adapter, (2) the combustion chamber, (3) the tapered section and (4) the tail pipe.

The adapter section is made by welding five steel stampings along their edges. This transition piece changes the engine shape from the rectangular section required for the grid assembly in the forward end to the cylindrical section required for the remainder of the shell. This detail is clearly shown in the left foreground assembly of Fig. 2. The unit, welded as a subassembly, is fabricated from low-carbon, cold-rolled stock, 0.0938 in. thick. Despite the comparatively short length of the section, approximately 90 in. of manual arc welding are required to join its five steel stampings.

The adapter, incidentally, houses what is probably the most interesting part of the engine—the grid and fuel jet assembly. This is a radical departure from anything hitherto developed in America and bears a close resemblance to the original German design.

Grid Design

The grid consists of 15 aluminum grid bars, die cast from a permanent mold, and 16 flapper plates, set alternately in place. The spring steel plates, approximately 15 in. long, are riveted to their supporting bars, and this is the only riveted construction on the whole JB-2 engine.

Three of the grid bars carry three fuel jets each. Gasoline is sent to the jets through a manifold of copper-clad steel tubes silver-brazed to the jets. A further refinement from the German design is the installation of three small impact-air tubes above the top three jets. By connecting these

Fig. 4 (above)—Final assembly of the engine shell's four sections involves some 187 in. of circumferential seam welding. This arc welder is putting the finishing touches on the 21 inch diameter combustion chamber.

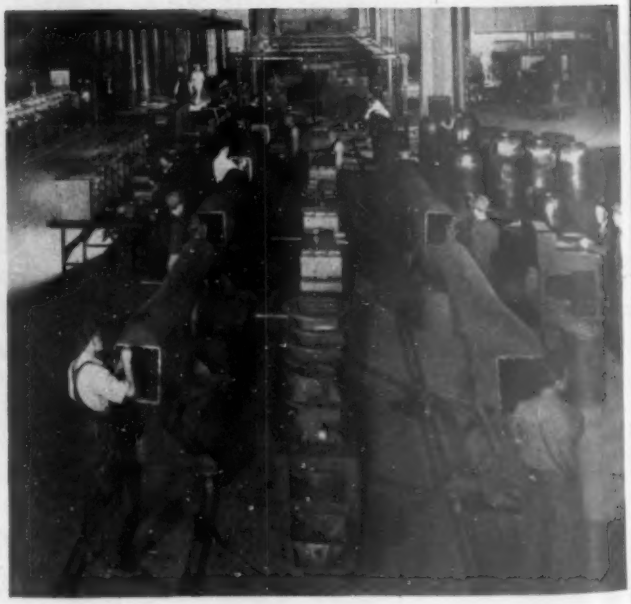
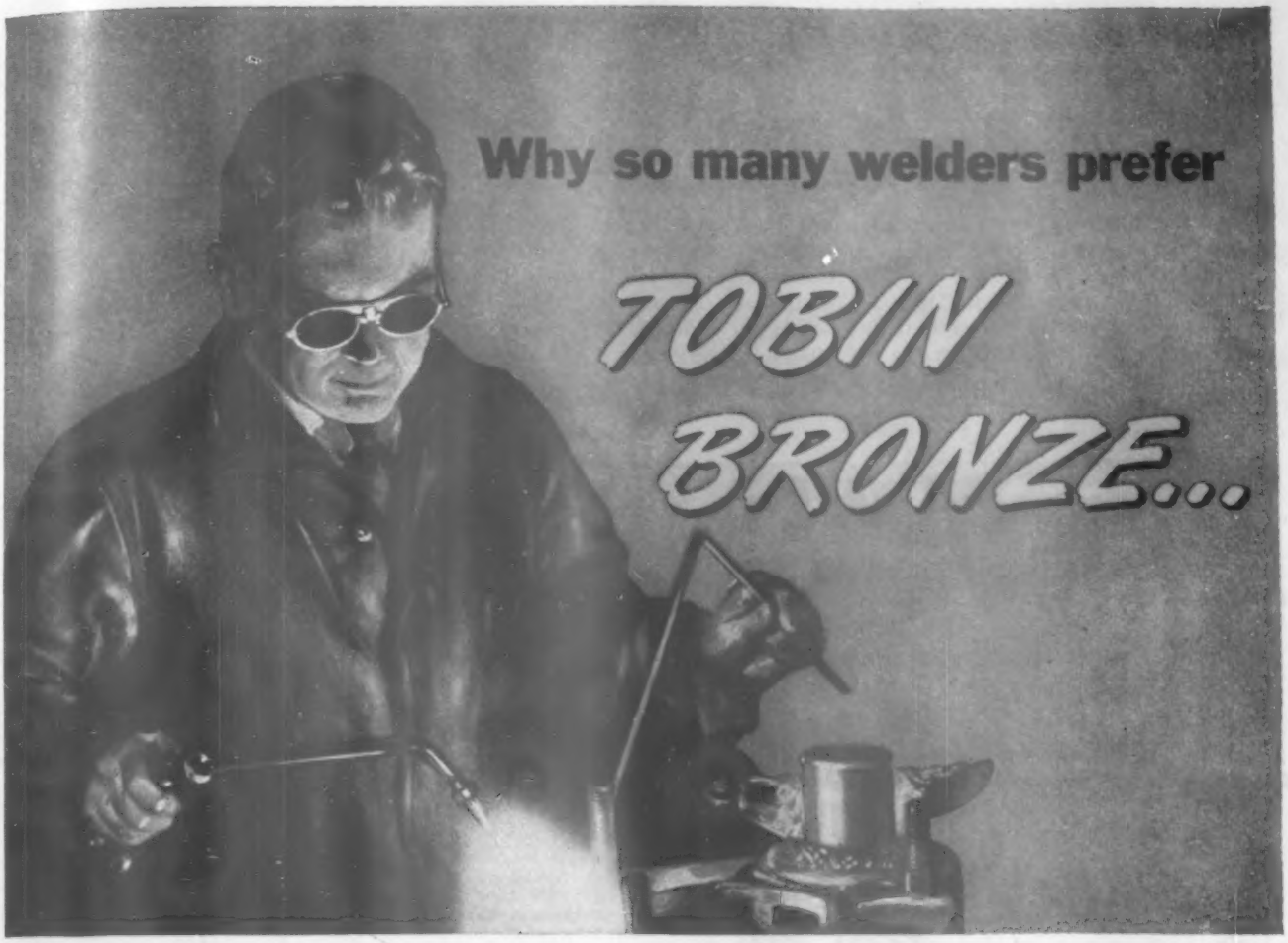


Fig. 5 (right)—Another view of the Ford bomb-engine assembly line. The workmen in the foreground are placing venturis, grills and nose cowlings on the partly completed engines.



LOW MELTING POINT, 1625° F.
SAVES TIME, OXYGEN AND ACETYLENE
MAKES DENSE, TOUGH WELDS
FLOWS FREELY • UNIFORM COMPOSITION

FEW WELDING RODS combine all the advantages offered by Tobin Bronze*. That is why this general-purpose Anaconda Welding Rod is so widely used for repairs to cast and malleable iron, steel, copper, nickel and their alloys.

Quick, sound repairs with Tobin Bronze are daily putting damaged production machines back to work. As a result, "Don't Scrap It . . . Bronze Weld It!" has become in recent years a country-wide slogan for war plants.

For detailed information on Tobin Bronze and other Anaconda Welding Rods, write for Publication B-13, "Anaconda Welding Rods."

*Reg. U. S. Pat. Off. 46111

• • •

NOTE: Restrictions which have controlled our facilities and products for war purposes have been relaxed. We are now permitted, subject to any continuing requirements of the Government, to resume manufacture for many civilian uses.

Keep Faith With Your Fighters and Yourself! Buy War Bonds for Keeps

ANACONDA

Anaconda Welding Rods

THE AMERICAN BRASS COMPANY—General Offices: Waterbury 88, Connecticut

Subsidiary of Anaconda Copper Mining Company · In Canada: ANACONDA AMERICAN BRASS LTD., *New Toronto, Ont.*

tubes to the fuel supply with other tubing, the internal air pressure resulting from combustion is used to control a fuel meter. The metering device (Fig. 3) may be likened to a carburetor and involves in itself several welding operations. The fuel line assembly requires 29 silver-brazed joints, the metering unit cover six spot welds, and the filtering unit two 1 in. silver-brazed joints.

On the finished engine the transition or adapter piece is covered with the front cowling, which serves as a fairing around the grid assembly. This cowling is fabricated from 0.0312 in. low-carbon, cold-rolled steel. Some 48 in. of oxy-acetylene brazing as well as 72 in. of roller-seam resistance welding are required in the fabrication of the cowling.

Combustion Chamber

Immediately behind the transition piece is found the circular combustion chamber (Fig. 4). Measuring 19⅝ in. long, this section is fabricated from a single sheet of 0.0938 in. low-carbon cold-rolled steel which has been rolled into a 21 in. cylinder. It is welded automatically along the longitudinal seam by submerged-melt welding.

Following towards the tail are two other subassemblies: the tapered section and the tail pipe. Both of these are made from 0.109 in. low-carbon, cold-rolled steel. Submerged-melt welding is used again for the tapered section's longitudinal seam of 35¾ in. and for the tail section's 69 in. longitudinal seam.

Final assembly of all these various subassemblies is a manual arc welding job (Fig. 4), involving some 187 in. of circumferential seam welding.

Venturi and Diffuser

While this would seem to be sufficient welding to build such an item as this resojet engine, a venturi and a diffuser must also be added. The venturi (Fig. 5) is fabricated from 0.0781 in. low-carbon, cold-rolled steel and requires 88 in. of manual arc welding and 56 spot welds. The diffuser, which also sets inside the engine, is of low-carbon, cold-rolled stock, 0.0938 in. thick, and requires 32 in. of manual arc welding as well as 34 spot welds for the attachment of brackets and washers. As a final touch, the engine is provided with a yoke and rear bracket to permit it to be readily attached to the bomb. Some 141 in. of manual arc welding are required on the yoke, while 40 in. of manual arc welding are needed at the point where the bracket is joined to the tail section.

The robot bomb for which these Ford-made engines are constructed consists of a highly streamlined fuselage with stubby wings. The tube containing the jet-impulse engine is mounted above the fuselage, which contains the warhead, fuel, automatic control equipment and two spherical compressed-air tanks for running the control units.

Robots in Action

The motive power comes from a series of rapid explosions in the engine's combustion chamber. The force of these explosions follows the line of least resistance—the open rear end of the tube — and so drives the aerial bomb forward. The tube's front end is equipped with an ingenious shutter gate which opens to admit air for combustion and closes before each explosion to prevent a loss of power. In action, the bomb has an earth-shaking roar that sounds like a giant outboard motor.

Overall, the American model flying bomb measures about 17 ft in span and 27 ft in length. Before long Hirohito's buck-toothed playmates will undoubtedly be able to give us specific reports of the JB-2's devastating effect.

. . . ADD POWER
ADD MANPOWER
ON YOUR WELDING OPERATIONS
with
BURDOX Extra-Flex CABLE
Thousands of twisted wires properly shaped provide extra flexibility. Less tiring for worker to handle.
Bright copper wires of hair width sizes provide high conductivity. Steadier power on the job.
Tough construction offers greater resistance to abrasion, oil and water. Less time out for repairs or replacement.
Heavy live rubber jacket and wrapping of heavy tape protects wires. Prevents "shorts" and breakdowns on job.

Minutes saved on welding operations mean more welds completed . . . greater production with less manpower. Burdox Extra-Flex Cable cuts welding time because it works with the worker . . . coils readily and easily . . . delivers its power steadily . . . lasts longer because of special construction. Costs less than you would expect of cable of such high quality. Available in sizes from 6 to 4/0 from all welding supply distributors.

THE BURDETT OXYGEN COMPANY
3304 LAKESIDE AVENUE • • • CLEVELAND, OHIO

★ THE BURDOX LINE INCLUDES
Welding and Cutting Outfits • Welding Rods • Acetylene Generators
Hose and Hose Connections • Cylinder Trucks • Face Shields • Goggles
Lenses • Regulators • Torches • Pressure Gauges ★

★ *Write for the new Burdett Catalog of Welding and Cutting Products*

BURDOX HELMETS *give workers a "HEAD START"*

Designed to give workers comfort *plus* protection, Burdox Helmets are streamlined, yet sturdily built. Have a two-way adjustable head gear, with parts that come in contact with head well covered. A wide range of types in both regular and flap front styles. Also handshields of the same construction.

PRODUCTION UP REJECTS DOWN

Flexarc ACP Electrodes speed production of sound welds in all positions . . . .

It makes a lot of difference which electrode your operators use. If they don't have a supply of the new Westinghouse ACP Electrodes, you are missing one of the most important welding developments in the past ten years.

You can speed up work with the new ACP and improve the quality of welds. The ACP rod forms a light, porous slag which can be easily removed by light brushing without waiting for the weld to cool.

And welds with an ACP electrode are strong, dense and ductile. Your operators will immediately sense a new drive and penetration with the ACP electrode. It produces excellent results in making lap joints and horizontal fillet welds. Equally important to you is the fact that the ACP is an all-position a-c or d-c electrode.

For complete information about this new electrode, write today for a copy of B-3353, Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pa.

J-21338

WHY ACP ELECTRODES ARE PREFERRED FOR ALL-ROUND WORK WITH A-C OR D-C

- Easy slag removal. Light porous slag permits quick removal with stroke of welding rod or light brushing . . . minimum amount of time and effort.
- No sag in overhead welds. Good flat beads . . . easy flow . . . that really stay put.
- Easy arc control in all positions . . . excellent physical properties.
- Forceful direct arc, plus excellent metal transfer, gives high penetration with complete fusion and easy manipulation.
- High speed, high burn-off rate.

ACP electrodes meet AWS and ASTM Specifications, Class E-6011 and E-6010.

Westinghouse
PLANTS IN 25 CITIES . . . OFFICES EVERYWHERE

FLEXARC ACP ELECTRODES

ONE OF THE WESTINGHOUSE "BIG 5"

On the Job

Welded Truss Design

A NEW design for welded trusses of standard 50, 60, 70 and 80 ft lengths was recently adopted by the Austin Co., Cleveland. According to J. K. Gannett, Austin vice-president and director of engineering, this is the first time that H-sections with their webs in a vertical plane are used throughout without gusset plates.

Fabricating one of The Austin Company's new H-trusses. It consists entirely of rolled H-beams and I-beams, cut to lengths and joined by welding.

The new truss is a "natural" for welding. Shop fabrication of a 50 ft truss requires a total of 41 lineal feet of fillet welds, all of which are made by downhand welding. The H-beams are assembled in a jig and tack welded, after which the welding is completed with the truss in a vertical position. The vertical and diagonal members are joined to the top flange of the beam forming the bottom chord (shown in accompanying illustration) and to the bottom flange of the top chord.

The truss is completely fabricated from rolled members, which are simply cut to the desired lengths. No splitting, blocking, slotting or chipping is necessary. The raw cut edges are closed by the welds so that the only surfaces exposed are the smooth, hard rolled surfaces. This gives the truss a maximum of corrosion resistance.

This truss is readily adaptable to different loadings by simply changing the weights of the beams used for the various truss members. By keeping the depths of the individual members constant, these variations require no changes in shop details or fabricating jigs. As the top chord is a wide flange beam, it can carry purlins at a variety of spacings without regard to panel points and is also adaptable to continuous uniform loading. Similarly, the bottom chord can carry loads at any point and can be used, itself, as a monorail.

» «

All-Welded Hospital

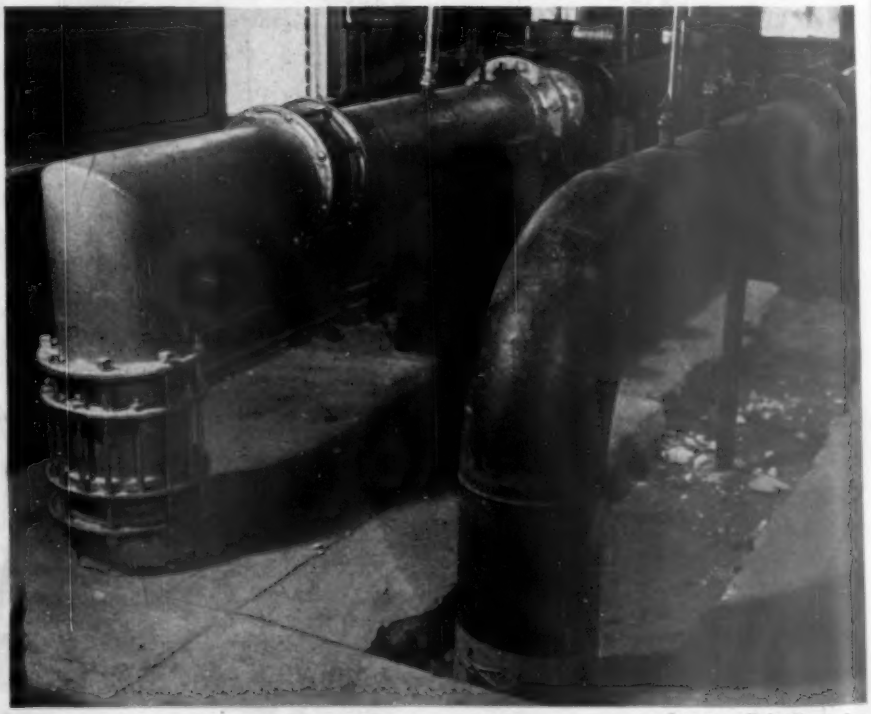
PRELIMINARY details on what is believed to be the first all-welded hospital building in the country have been received by officials of The Lincoln Electric Co. The 18-story Kahler Hospital, to be erected at Rochester, Minn., will have a framework designed as a continuous structure of welded beams and their connecting members. In preparing the specifications, the architect, Ellerbe and Co., St. Paul, discarded all concepts of riveting so that the welding details might not be restricted by unnecessary conformance to the traditions of riveted construction.

» «

Square Corners Obsolete

IN horse-and-buggy days roads could be built with right-angled corners but not when motor cars became fashionable. Likewise, today's demands on industrial piping systems—the liquid and gas highways—necessitate transportation mediums without square corners.

The accompanying picture gives a specific example of the old and the new ways of doing it. When 16 in. natural gas lines were installed in the Cannon's Lane station of Louisville Gas & Electric Co. in 1927, the mitered corners were the customary thing in welded piping. But proof that the square corner is a bottleneck even for gas was



Courtesy, Tube Turns Inc.

The square corner is a bottleneck in piping while the 90 deg elbow permits a continuous flow.

brought to light recently when one of the lines was replaced with new piping containing a 90 deg elbow. Ridges of tar deposited in the mitered elbow indicated an extreme turbulence, with the direction of gas flow on the outside edge apparently reversed. Flow through the welding fitting is uninterrupted.

» «

Shipboard Welder

FIRST public disclosure of a lightweight, portable welder for warships was made recently by General Electric, its developer and producer. The new G-E shipboard welder weighs but $\frac{1}{10}$ of the previous cumbersome welding installation required. Motor, generator, meter starter and generator control are combined into a single compact assembly, which is small enough to pass easily through a 16 by 16 in. hatchway.

When necessary, two or more welders can be connected together to increase the current output for special jobs such as underwater welding or cutting operations.

Availability of a sea-going welding system on board a warship offers several distinct advantages. When the vessel has been damaged in battle, the welder may make it possible to effect emergency repairs so that the ship can be kept afloat until a safe harbor is reached. Or lesser damage can be repaired while the ship is still on its mission.

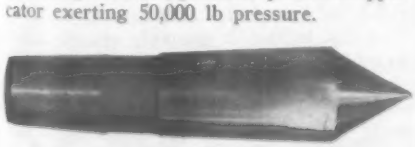
Previous shipboard welding systems weighed about 4,000 lb and required as much as 12,000 ft of cable on larger ships as well as special outlets for the power supply. Special outlets are not needed with the new welder, and its mobility greatly reduces the amount of cable required. It is of shockproof construction and rigorously tested to make certain that it can withstand battle conditions.

» «

Flash-Welded Lathe Center

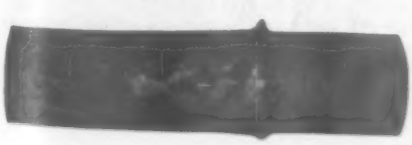
THE precision welding of high-speed-steel tips to carbon-steel shanks is a trick that suddenly became popular after American industry had been rudely isolated from the tungsten deposits of China. The accompanying pictures show its application to an extremely large lathe center produced by the Erie Forge & Steel Co., Erie, Pa.

This lathe center is 4½ in. in diameter and has an overall length of 18¾ in. The high-carbon shank is 12¾ in. long, the high-speed-steel tip 6 in. The welding was done on a 300 kva flash welder having horizontal air clamps and a hydraulic pressure applicator exerting 50,000 lb pressure.



Courtesy, Thomson-Gibb Electric Welding Co.

This big lathe center has a high-speed-steel point welded to a high-carbon-steel shank. Below is the flash-welded blank from which the finished center is turned out.



Titan Bronze Welding Rods will readily solve problems encountered in welding Cast Iron, Malleable Iron, Steel, Wrought Iron, Brass and Bronze, Galvanized Iron, or any other non-leaded metal which melts above 1625° F.

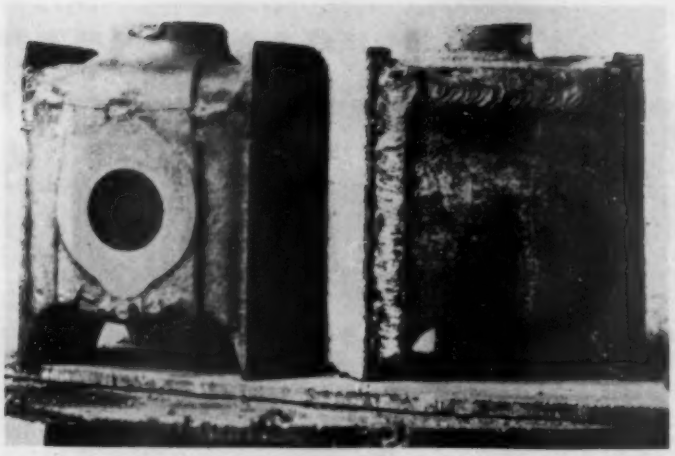
Any of Titan's Bronze Welding Alloys can be used with success as a general purpose rod. However, best results are obtained by selecting the rod containing those properties which will be demanded of the weld in service.

Write for complete details on the following Titan Bronze Welding Rods:
PENN BRONZE • TITAN BRAZING BRONZE
TITAN BRONZE • TITAN WEARWELL • TITAN
NAVAL BRONZE • TITAN MANGANESE
BRONZE • TITAN NAVAL
MANGANESE BRONZE

Titan

METAL MANUFACTURING CO., BELLEFONTE, PA.
NEW YORK • CHICAGO • NEW ORLEANS • SAN FRANCISCO

Quality Alloys By Brass Specialists
Brass and Bronze Rod • Forgings • Die Castings • Welding Rods



Welded steel crosshead (right) made to replace a broken cast-iron crosshead (left) for an air compressor. The broken end of the old crosshead has been tacked on to obtain measurements.

Fabricated Crosshead

By Chester L. Wright

A CAST-IRON crosshead for an air compressor fractured, and there was no time to wait for a replacement. It was decided that an even more satisfactory steel crosshead could be fabricated on the job by flame-cutting and welding. The results are shown in the accompanying picture. Two side pieces, two edge pieces and one end piece were cut and welded together to make the crosshead. The end piece was threaded to receive the piston rod.

» «

Tool Display Rack

By Charles C. Lynde

THE weldor for one oil drilling contractor fabricated a flanged top for the usual all-welded steel tool box in order to provide handy access to the tools. One flange, instead of being welded to the top plate, is actually an extension of the back of the box. It extends to a height equal to the cover flange, and the two are hinged together with a series of welded eyes and a long through bolt.

Welded flanged top for a hand tool box. The hooks hold wrenches, hammers, etc.

Hooks welded at properly spaced intervals to the lower or inner sides of the top provide for the display of wrenches, hammers and other hand tools. The hooks are made long enough to retain the tools but short enough so that when the lid is closed they will clear the working surface or top of the box proper.

To fix the top rigidly when in the open working position, this weldor made two braces of ¾ in. rod and welded ears (lugs) to the ends at angles giving flat contacts with the top of the box and the cover. Holes were placed so that the braces could be fastened by through bolts and unbolted when the lid is closed.

CHEK-SHOCK OXYGEN CUSHION VALVE

SOFTLY controls the vicious "jolt" of high pressure oxygen gas, thus eliminating regulator repairs and preventing possible injury to operators.

- Will allow tank valve to be opened rapidly without damage to regulator or danger to operator.
- Will increase life of regulator assembly.
- Will eliminate possible injury to operator from burstings.
- Will prevent unnecessary internal wear in regulator *(as NOT necessary to release control screw before opening tank valve).*

This PROVEN automatic safety device cushions the initial "blast" of pressure when tank valve is turned on, (this uncontrolled surge which strikes like a hammer is the direct cause of most damaged regulators and accidents), when pressure slowly bleeds and equalizes then CHEK-SHOCK allows a full flow of oxygen.

PRICE IS LESS THAN ONE REPAIR BILL

1. STANDARD COUPLER—for all standard size welding type oxygen regulators.
2. LIGHT COUPLER—for "airplane" or soldering size oxygen regulators.
3. HEAVY DUTY COUPLER—recommended for extra heavy duty work only.
4. SCREW TYPE COUPLER—for removable inlet stem regulators (¼" pipe) available in standard, light, or heavy capacities.
5. FOR HYDROGEN—left hand thread coupler. We also make Medical Chek-Shocks for all types of medical regulators and tank fittings (chrome plated).....$7.00 each

$6.00 ea.

SEE YOUR DISTRIBUTOR OR WRITE

Chek-Shock MFG. CO.

FOWLER CALIF.

WHY BOTH MANAGEMENT AND OPERATORS PREFER "Bumblebee" A.C. ARC WELDERS

We get better welds and more of them since we bought "Bumblebees"

- Production increases of 15% to 30% without sacrifice of quality are common.
- They consume 30% to 35% less power than D.C. welders — cut power costs.
- They provide leading kva which neutralize lagging kva caused by other equipment, relieving overloaded power lines and cutting demand charges 10% to 30%.
- Because of freedom from arc blow, deposition rates can be speeded up by increasing the amperage. This often makes it possible to use larger, longer electrodes and cut down stub end losses.
- Absence of moving parts, tough, he-man construction and top-notch insulation assure dependable, trouble-free operation — eliminate shutdowns for repairs and replacements.

It's easy to do a swell welding job with a "Bumblebee" at the other end of the cable.

- There's almost no "arc blow". You can work faster in any position and you're sure of good, sound welds every time.
- It's easy to produce sound, uniform welds in the corners and tight spots—there's less chipping out of welds.
- It's often possible to use longer and larger electrodes; there are fewer stops to put new electrodes in the holder.
- It's a simple matter to adjust the current for different kinds of work — just turn the crank.
- The current setting is always plainly visible on the big easy-to-read indicator.
- They're dependable — don't require oiling or other attention. An operator can concentrate on welding.

These are a few of the important advantages which are making "Bumblebee" welders favorites in plants everywhere. Others are described in the "Bumblebee" Catalog. Ask your nearest Airco office for a copy or write Dept. WE, Air Reduction, General Offices: 60 East 42nd Street, New York 17, N. Y. In Texas, Magnolia Airco Gas Products Co., General Offices: Houston 1, Texas.

AIR REDUCTION

OFFICES IN ALL PRINCIPAL CITIES

AIRCO

WILSON "Bumblebee"

Registered U. S. Patent Office

A.C. ARC WELDERS

WITH THE PENETRATING, STINGING ARC

A COMPLETE LINE OF A.C., D.C. AND GAS-ENGINE DRIVEN UNITS

Short Cuts and Kinks...

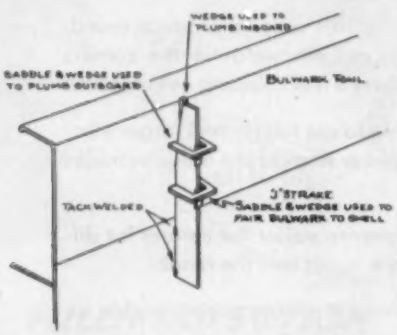
Help Speed V-J Day

A few of the many time and labor-saving ideas developed by tacticians of the production line are presented every month in this department. If you have a good welding idea of your own to pass along, you are hereby invited to contribute it to the cause of final victory. Send anything you think suitable to: Short Cuts and Kinks, THE WELDING ENGINEER, 506 S. Wabash Ave., Chicago 5.

Bulwark Landing and Fairing

By W. E. Powell

IN ORDER to land the bulwark rail, pieces of metal are tack welded to the ship's shell, allowing a small amount to protrude above the "J" strake. This is done in order to guide the bulwark rail along the top of


WEDGE USED TO PLUMB INBOARD
SADDLE & WEDGE USED TO PLUMB OUTBOARD
BULWARK RAIL
J" STRAKE
TACK WELDED
SADDLE & WEDGE USED TO FAIR BULWARK TO SHELL

Bulwark landing and fairing device. The strongback tack welded to the "J" strake replaces the usual guide rails.

the plate. The bulwark was later faired by means of dogs, wedges, clips and bolts, etc. After it had been faired, the shipwrights plumbed the rail by means of turnbuckles and clips. This procedure wasted a considerable amount of time and material.

It seemed to me that we were doing the job the hard way, so I suggested to the Labor-Management Committee, Richmond Shipyard No. 1, Richmond, Calif., what I believed to be an easier method. Acceptance of the suggestion proved I was right.

The idea involves the use of a specially designed strongback that is tack welded to the "J" strake so that one half of it extends above the plate. The bulwark can now be landed without any preliminary welding of guides since the strongback accomplishes the same purpose. A saddle is welded just above the seam of the rail and plate, and a wedge is driven between the saddle and strongback. This automatically fairs the bulwark rail to the "J" strake plate. The upper saddle and wedges are used for plumbing. To plumb inboard, a wedge is driven between the top of the rail and the strongback, as per sketch. To plumb outboard, a saddle is tack welded to the rail and a wedge is driven in place.

Time is saved by being able to perform various operations without the necessity for obtaining extra miscellaneous material.

» «

This table for flame-cutting work was built entirely of scrap material.

Flame-Cutting Table

By Ben L. Byer

A SATISFACTORY table for flame-cutting operations is all too often a rarity around a welding shop. This is not the case, however, at the Yates Welding Shop, Pasadena, Calif.

Mr. Yates decided to build a table that would withstand the rugged service to which flame-cutting tables are subjected. He built it wholly from scrap. The framework was originally the frame of a washing machine, the grating an old cast-iron sidewalk grating. Inasmuch as cast iron will not burn readily, Mr. Yates now has a cutting table that is almost everlasting (see picture above).

» «

Flame-Cutting Attachment

By Charles A. Larimer

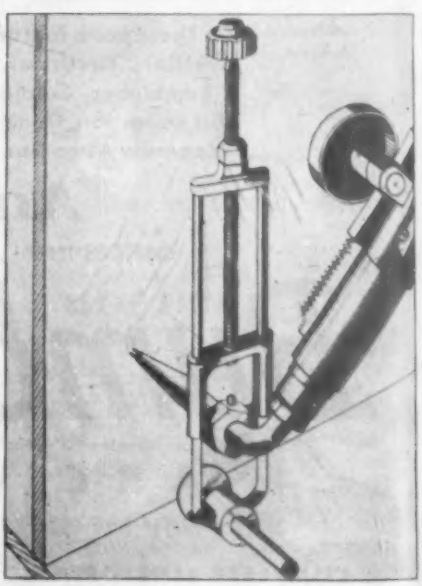
IN THE fitting of deck houses, bulkheads. etc., it is common practice to scribe and punch mark the walls for manual torch cutting. Following the flame-cutting operation, it was frequently necessary to make trim cuts before the flangers could pull a house down to deck. In addition, many dogs and clips were required to assist in this operation.

This seemed like an expensive way of doing a job, so I submitted to the Labor Management Committee, Richmond Shipyard No. 3, Richmond, Calif., a suggestion for the use of a guide wheel attachment for a flame-cutting machine to produce a finished edge on a deck house or bulkhead which conformed to the deck contour. The purpose of this suggestion was to reduce the flanging and flame-cutting man-hours spent in setting deck houses or bulkheads to the deck after inaccurate manual cutting.

Under this improved method, the excess material to be removed is predetermined, and the attachment is placed on a flame-cutting machine torch head. Then all swivel adjustment nuts are released sufficiently to allow vertical freedom in the movement of the head. As the roller tracks cross the deck, the flame-cut edge on the vertical plate duplicates the identical contour of the deck. Adoption of this suggestion has resulted in a 50% saving on all jobs where scribe flame-cutting was used. It is no longer necessary to scribe and punch mark the material. As a result, trimming has been eliminated as well as much of the flanging time.

» «

Guide wheel for flame-cutting machine. This attachment makes possible the production of plate edges which duplicate the deck contour, eliminating the need for trimming.



AMPCO-TRODE Sampler
Special Offer
Introductory Price $11.95
AMPCO-TRODE Coated Aluminum Bronze Electrodes
For welding brass, bronze, copper, steel, malleable iron, cast iron, nickel alloys and dissimilar metals; to build overlays to obtain maximum wear and bearing properties
AMPCO METAL INC. MILWAUKEE 4, WISCONSIN
5 GRADES
3 SIZES
1/8" — 5/32" 3/16"

Attention...

Job Shops . . . Garages . . . Welding and Maintenance Depts.

AMPCO-TRODE

REG. U. S. PAT. OFF

Sampler

Available to you. $15 worth of ALUMINUM BRONZE ELECTRODES

Introductory Offer **$11.95**

Physical Properties of AMPCO-TRODE					
...rties	Ampco-Trode 10	Ampco-Trode 160	Ampco-Trode 200	Ampco-Trode 250	Ampco-Trode 300
...p.s.i.	78000 91000	85000 97000	90000 101000	78000 86000	70000 73000
...h p.s.i.	37000 43000	35000 41000	34000 40000	39000 45000	48000 55000
...tion 2 in.	20 27	10 19	4 9	0.5 1	0.0 0.0
...ness 3000 Kg.	115 120	140 160	180 200	230 250	280 300
...r Code	Blue Tip	Red Tip	Black Tip	Yellow Tip	White Tip
...arity	Electrode positive; work negative. Light type, minimum; black type, average.				

...ere's a generous supply that ...repares you for any type of job

...s an example, with famous Ampco-Trode 10, you can ...eld dissimilar metals, manganese bronze castings, brass ...eets and plates, etc. With Ampco-Trode 160 and 200 ...ou get high-tensile welds for applications requiring good ...uctility and subject to severe conditions of wear and cor...rosion. Ampco-Trode 250 and 300 are ideal for wear-re...sistant bearing surfaces or where you need resistance to high compression loads.

With the Ampco-Trode Sampler you have a variety that enables you to weld a wide range of jobs successfully. Take advantage of this low price — write for yours today!

AMPCO

Ampco-Trode is a product of Ampco Metal, Inc.

Order Today!

AMPCO METAL, INC., Dept. WE-7, Milwaukee 4, Wisconsin

☐ *Please send us your introductory package of Ampco-Trode samples at $11.95.*

☐ *Have your distributor call.*

Name..... Position.....

Company.....

Address..... ☐ Home ☐ Office

City..... (.....) State.....

New Products to Use

Underwater Electrodes

★ Murex arc-oxygen underwater cutting electrodes, which were until recently manufactured solely for war purposes, are now commercially available. The arc-oxygen electrode utilizes an arc

Underwater cutting with the arc-oxygen electrode. This electrode was developed by Metal and Thermit in cooperation with the U. S. Navy.

temperature ranging from 6,000 to 10,000 F to kindle steel plate or beams to the melting point. A jet of pure oxygen is then introduced to cut cleanly through the steel.

Information has hitherto been restricted about this type of electrode. It has made possible the amazing speed with which invasion harbors have been cleared of sunken ships and has also permitted the underwater trimming and welding of ragged shell and torpedo holes in vessels afloat.

There are two main types of underwater electrodes, both having extruded waterproofed coatings. An underwater welding electrode, Murex type C W, is employed for welding plate from ⅛ in. to heavier thicknesses and can also be employed to cut material up to ¼ in. thick. This electrode is supplied in ⅛ to ¼ in. sizes, the 3/16 in. size being the most widely used for general salvage operations.

For cutting heavier plate than ¼ in., the C-T tubular electrode is employed. This is supplied in one size only: 5/16 in. OD and 0.112 in. (±0.008 in.) ID. Oxygen is passed through the opening in the tubular electrode. This type of underwater electrode shows cutting speeds ranging from 12 to 15 in. per minute for 1½ in. plate to 30 in. per minute for ¼ in. plate. Maximum cutting speeds range from 36 in. per minute for 1 in. plate to 62 in. per minute for ¼ in. plate.

In addition to steel, the tubular electrode may be employed for the underwater cutting of non-ferrous metals and iron or for the open-air cutting of difficult high-alloy steels such as austenitic stainless. **Metal and Thermit Corp.**, 120 Broadway, New York City 5.

» «

High-Tensile Electrode

★ General Electric "Type W-56" is a

Overhead welding with the new G-E W-56 electrode for low-alloy, high-tensile steels.

heavily coated electrode for welding low-alloy, high-tensile steels that meets the requirements of AWS E-7010 and E-7011 classes. It was specially designed for use on carbon-molybdenum steel in high-pressure piping, but it may also be applied to fittings on pressure vessels and structural weldments of many kinds. It operates on either a-c or d-c reverse polarity and can be used in the flat, vertical and overhead positions. Its range of current is said to be sufficiently broad to cover a wide range of plate thicknesses.

Features of the new electrode include a stable spray-type arc, deep penetration, excellent creep-resisting qualities. The covering produces an easily removed, light, friable slag. The W-56 electrode is available in ⅛, 5/32 and 3/16 in. diameters and complies with the Navy Bureau of Ships specifications 46E2. **General Electric Co.**, Schenectady 5.

» «

Electrode for Cast Iron

★ P&H "Harcast" is an improved electrode specifically developed for welding cast iron. It can also be used to weld cast iron to mild or medium steels. It produces a sound, dense, semimachinable deposit with a tensile strength of 60,000 psi.

Use of this electrode, manufacturer advises, avoids "fighting the arc" of cast-iron electrodes as well as worry over weld cracks, poor penetration, pulling away in the fusion zone or excess porosity. It can be used with either a-c or d-c, with low amperages, in all positions and for either single or multiple passes. Welding Division, **Harnischfeger Corp.**, 4400 W. National Ave., Milwaukee 14.

Jet-Propulsion Electrode

★ A new electrode for welding the metals developed for jet-propulsion engines is announced by **Arcos Corp.**, 1515 Locust St., Philadelphia 2. It produces a weld metal that is capable of withstanding the great temperatures and stresses encountered in jet-propulsion engines, but the chemical and physical properties can be revealed only to those manufacturers participating in this particular phase of the war program.

» «

Tungsten Electrodes

★ Welding electrodes made by **The Callite Tungsten Corp.**, Union City, N. J., will hereafter be identified by the trade-name "Puretung." These rods are 99.9% pure tungsten and are used in atomic-hydrogen and inert-gas-shielded welding. They are made in standard or of special-polished finishes, clean and black, in seven standard diameters and 12 in. lengths. Among other applications, they are being widely used for the welding of aircraft parts, especially hollow steel propellor blades and landing gears, for tank parts, tools, etc., also to alter dies to compensate for engineering changes. Bulletin No. 154, which describes various practical applications of "Puretung" electrodes, is available on request.

» «

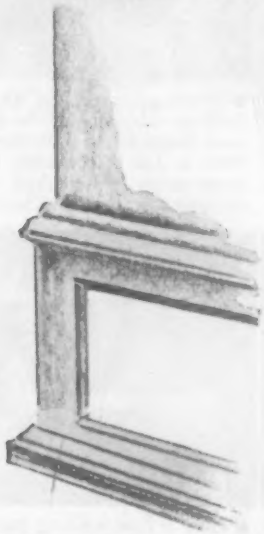
High-Speed-Steel Electrode

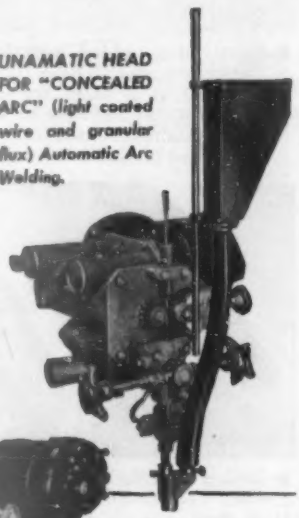
★ Amsco "Toolface" is a hard and tough alloy tool-steel electrode composed of high carbon, high chromium, high molybdenum, tungsten and vanadium. Its weld

This hammersmith swage was made by depositing "Toolface" on inexpensive carbon steel and forging to shape. Note that the line of fusion has not been affected by the forging operation.

deposits have a Brinell hardness of 575 to 675, depending on the dilution of the metal. This electrode was designed for hard-facing operations in which extreme hardness and resistance to shock and corrosion are required. It is especially adapted for the production of composite cutting tools, including those used on lathes, shapers and milling heads. Its ready weldability is said to expedite the deposition of cutting edges or lands on mild-steel bases or shanks. **American Maganese Steel Div.** of American Brake Shoe Co., Chicago Heights, Ill.

it's time to change....





UNAMATIC HEAD FOR "CONCEALED ARC" (light coated wire and granular flux) Automatic Arc Welding.

UNAMATIC HEAD FOR "PROTECTED ARC" (light coated wire and tape), Automatic Arc Welding.

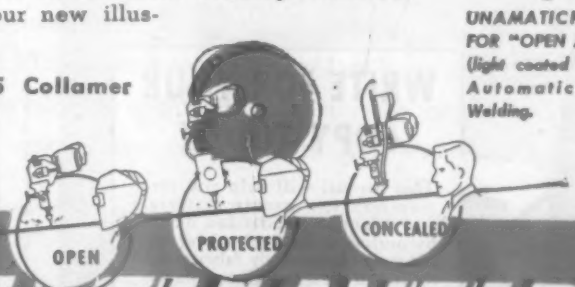
UNAMATIC HEAD FOR "OPEN ARC" (light coated wire) Automatic Arc Welding.

This gay young blade of the button shoe era is considerably behind the times . . . but no more so than many of the fabrication methods in use today, when compared with the modern Unamatic Arc Welding processes.

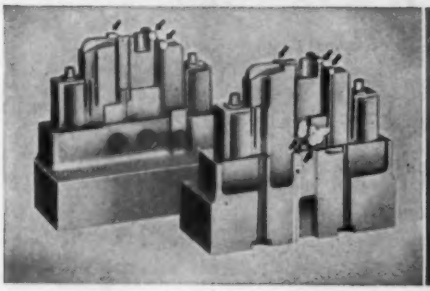
Providing the important advantages of faster production (2 to 3 times as fast as the manual process), reduced production costs (10 to 15% lower materials cost) and improved quality work, *Unamatic Welding is recognized as the modern method of metal fabricating.*

It will pay you to get the facts on Unamatic Welding. Write for complete information and our new illustrated bulletin . . . today.

UNA WELDING, INC. • 1615 Collamer Avenue • Cleveland 10, Ohio



UNAMATIC WELDING



● Costly dies welded with Eureka Tool & Die Electrodes. These intricate units were saved at a small fraction of their replacement cost and were back into operation with minimum down-time. Man hours, material and production time saved.

● When practical, die units can be compositely fabricated by welding. Above die units compositely constructed with Eureka Tool & Die Electrodes. Heat treatment unnecessary, other than tempering. Last operation is finish machining.

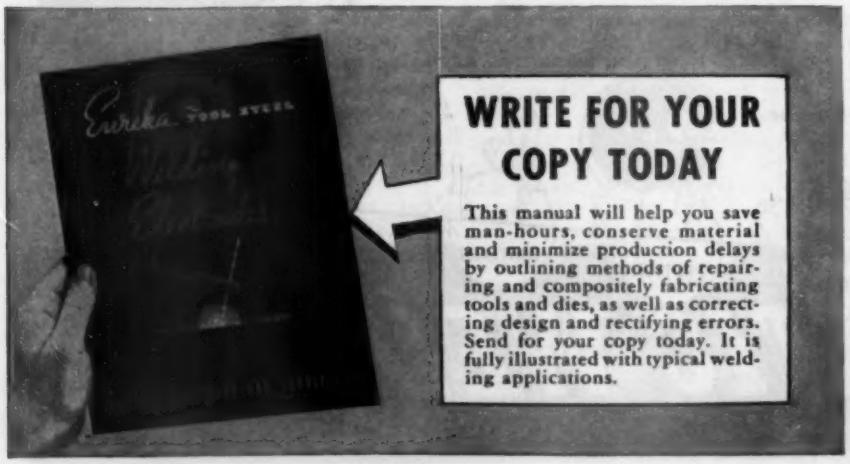
● Design corrected or error rectified using Eureka Tool & Die Welding Electrodes. Weld deposit is roughly finished. You can make change in contours, corners or edges to correct design during die "try-out" or during "change-over" periods.

● Here is how welding rectified mistake in machining a new forging die. Error was corrected by building up with Eureka "Drawalloy" Electrodes, thereby saving $500 in time and material and eliminating unsatisfactory inserts.

Welding Equipment & Supply Co.

PIONEERS IN TOOL AND DIE WELDING ELECTRODES

223 LEIB STREET • FITZROY 3715 • DETROIT 7, MICHIGAN

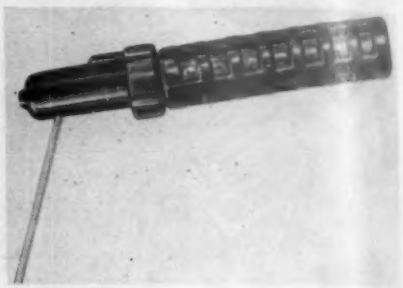


WRITE FOR YOUR COPY TODAY

This manual will help you save man-hours, conserve material and minimize production delays by outlining methods of repairing and compositely fabricating tools and dies, as well as correcting design and rectifying errors. Send for your copy today. It is fully illustrated with typical welding applications.

Collar for Electrode Holder

★ An all-plastic, four-cornered collar has been incorporated in the 300 amp "Stubby" electrode holder manufactured by **Martin Wells,** 5886 Compton Ave., Los Angeles 1. This feature makes electrode changing easier by providing the operator with a positive, convenient grip on the insulator. The collar also remains cooler than the cap, making electrode changing more comfortable. Another advantage is that small rods are held upright and away from contact with the work because the corners of the "mitt-grip" collar keep the holder from rolling.



A "mitt-grip" collar is the latest feature added to Martin Wells' "Stubby" electrode holder.

» «

Portable X-Ray Tube

★ The new X-ray unit illustrated was developed in order to examine the internal structure of welds and other vital points of stress in confined spaces such as airplane wings, fuel tanks, etc. The shockproof tube, approximately 3 in. in diameter, is coupled to the generator by means of a shockproof cable and two small hoses for the cooling water. The tube is clamped to or held against the section under examination while X-ray film is being held on the opposite side of the area. Controls include a stepless kilovoltage regulator, filament rheostat, circuit breaker (serving as main control) and a high-voltage pushbutton switch. A milliammeter is provided for proper adjustment of the tube current. **North American Philips Co., Inc.,** 100 East 42nd St., New York City 17.

North American Philips portable tube X-rays warplane wings or other confined spaces.

NOW'S THE TIME FOR *Your* BIG "MOP-UP"!

RE-SOLICITATION is the keynote for a victorious "mop up" in the Mighty 7th War Loan. Bond rallies plus continuous competition between departments help to keep Bond subscriptions on a quota-topping climb. Strategic poster displays . . . showings of "Mr. & Mrs. America," the Treasury film . . . distribution of the War Finance Booklet, "How To Get There," and the handy Bond-holding envelopes play an important part. But, above all else, arrange to have every employee asked *once more*—and personally urged *once more*—to meet his personal quota in the Mighty 7th!

The Payroll Savings Plan is the mainstay of every War Loan—meeting your plant quota is vital to the success of the 7th! Remember we have to make two drives in 1945 do the work of three last year. Put on an intensive "mop up" final to help mop up the Japs, cut the tentacles of inflation—and lay the foundation of security.

The Treasury Department acknowledges with appreciation the publication of this message by

THE WELDING ENGINEER

★ *This is an official U. S. Treasury advertisement prepared under the auspices of Treasury Department and War Advertising Council* ★

Sweatband

★ An absorbent sweatband made from synthetic sponge is announced by the **American Optical Co.**, Southbridge, Mass., for weldors, foundrymen and other workers on hot jobs. It is 7¼ in. long and covers the greater width of the brow. By keeping sweat out of the eyes and off goggles, this band helps reduce the possibility of accidents from blurred vision. It is comfortable to wear and can be easily sterilized for continued use.

» «

Pneumatic Die Grinder

★ A pneumatic die grinder for continuous high-speed operation has been added to the die grinder line developed by **Keller Tool Co.**, Grand Haven, Mich. Three models are available: Model No. 1505A equipped with collet chuck for holding mounted grinding wheels with ¼ in. diameter shanks; Model 1505B equipped with adapter for holding unmounted grinding wheels with ¼ in. diameter holes; Model No. 1505C equipped with ¼ in. capacity Jacobs chuck for small, light drilling at high speeds. All models have a speed of 25,000 rpm, are 6¾ in. long and weigh 18 oz.

New 25,000 rpm pneumatic die grinder added to the Keller line.

» «

AO safety glove. It is designed for long, hard wear on welding jobs.

Weldor's Glove

★ A new weldor's safety glove made from high grade chrome-tanned cowhide is featured by one-piece back construction. There are no seams at all on the back of the glove to catch sparks or molten metal. At other places the number of seams is reduced to the absolute minimum. To give added strength and protection, all vulnerable seams are welted. **American Optical Co.**, Southbridge, Mass.

» «

Spatter Preventative

★ Lincoln "Non-Spatter" film is a liquid designed to minimize the adherence of welding spatter to metal. Field tests, states manufacturer, reveal the following characteristics:

Welding can proceed after application, whether the film is wet or dry.

The film can be sprayed with an air gun or painted with a brush on the areas adjacent to the joint to be welded and to welding jigs that it is desired to protect from spatter. After welding, the spatter is easily removed by wiping or brushing.

Priming coats of paint may be applied over the film. If it is desired to remove the film before painting, however, this can be accomplished by merely washing it away with water.

One application of the film is effective for multiple-pass welding.

If the film is sprayed or painted on parts that are to be normalized, the oxide film and ordinary scale can be more readily removed after the heat treatment.

The "Non-Spatter" film is supplied in concentrated form in 5 gallon cans. This concentrated material is diluted for use with three parts of water. **The Lincoln Electric Co.**, Cleveland 1.

(Please turn to page 74)

"FOR HIGHER PRODUCTION, SPECIFY G-R"

SIMPLE LOGIC...

➡ PROVING that a. c. welding steps up production is simple logic. You can use higher heat with a. c. because there's no magnetic blow. Higher heat means faster burn-off; faster burn-off means higher rate of deposit. And higher rate of deposit means more welding per hour... *higher production every shift.*

There's simple logic behind G-R's superiority in the a. c. field, too. First, the design is *right*; G-R's exclusive, patented transformer design delivers a smooth, stable arc that's easy to handle in *all* positions, plus *full-range* control that gives you *exactly* the heat each job requires. Second, G-R's are built with an exceptionally high ratio of copper and iron per ampere of capacity... heavy-duty transformer construction that means not only top-notch performance, but also long, trouble-free service on tough, continuous production work, without the use of fans or auxiliary cooling.

G-R's are available in standard models from 100 to 2500 amp. ratings, for manual or automatic welding. For details, prices and delivery information, see your nearby G-R distributor or write directly to:

GLENN-ROBERTS COMPANY

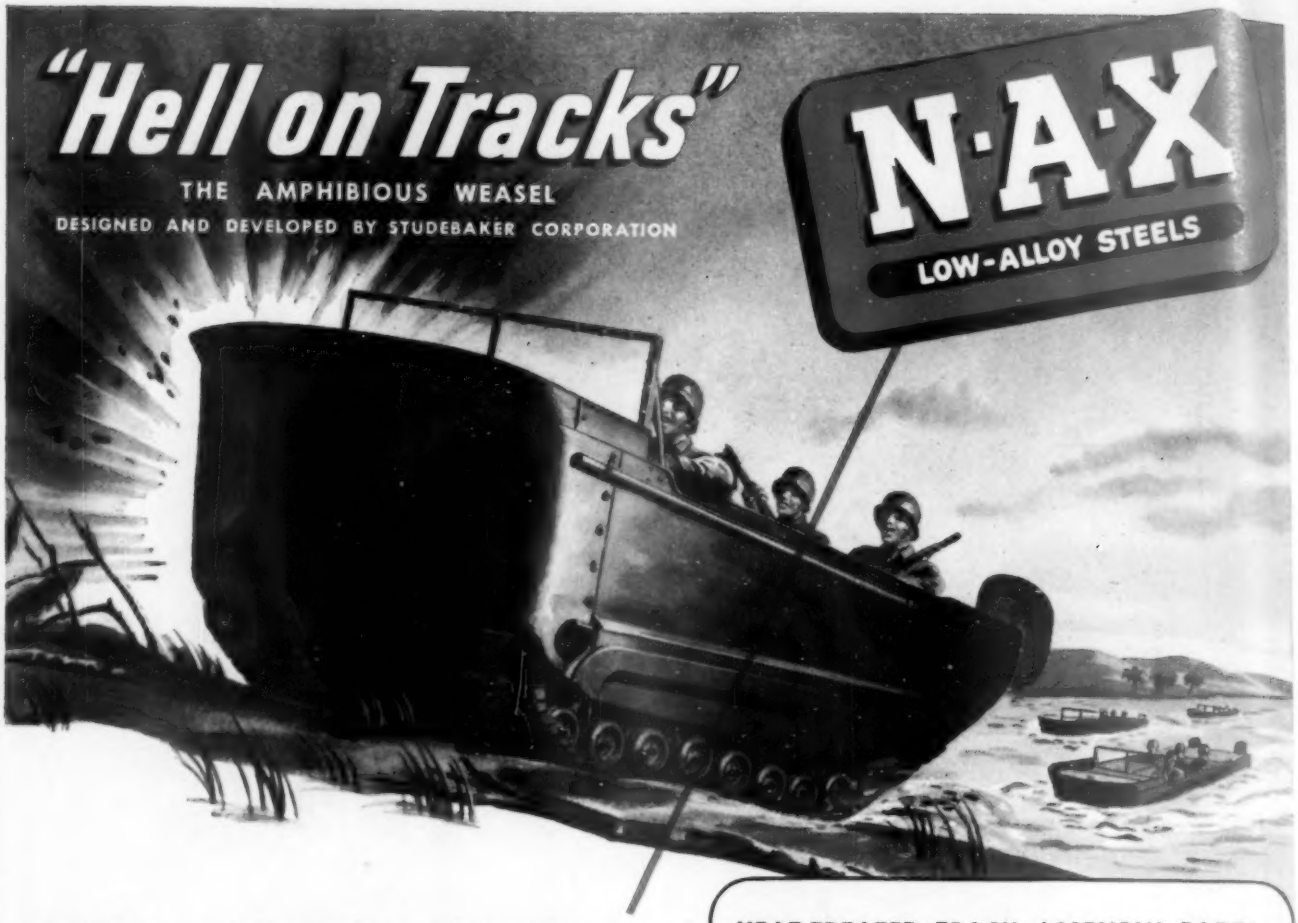
3100 E. TENTH STREET • OAKLAND 1, CALIFORNIA

1501 ADAMS STREET • INDIANAPOLIS 7, INDIANA

CHROME-NICKEL and STRAIGHT CHROMIUM STAINLESS STEEL ELECTRODE COMPARISON CHART

Type No.	302 304 308	309 309+Cb	310 310+Cb 310+Mo	311	316 316+Cb	317	329	330	347	403 410	430	442	446	501 502	Mn. Modified 307
Air Reduction *Airco	19/9	25/12 25/12Cb	25/20		18/8Mo				19/9Cb					4/6CrMo	204
Allied Welderaft *Stain-Craft	Type 308	Type 309 25/12Cb	Type 310 25-20Cb 25-20Mo	Type 311	Type 316 18/8Mo	Type 317 18/8Mo	25/3Mo	Type 330	Type 347 18/8Cb	12	16	18	28	5M	Armor-Craft
Allis-Chalmers	308	309 309Cb	310 310Cb						347						
Alloy Rods *Arcaloy	Type 308	Type 309 Type 309Cb	Type 310 Type 310Cb Type 310Mo	Type 311	Type 316 Type 316Cb	Type 317	Type 329	Type 330	Type 347	Type 410	Type 430	Type 442	Type 446	Type 502	Armorare Type B Armorare Type N
Arcos *Chromend[1] *Stainlend	K Stainlend K	HC 25/12Cb[2] Stainlend HC	HCN[2] 25/20Cb 25/20Mo	HN	KMo[2] KMo Cb	18/8Mo	25/3Mo	15/35[3]	19/9Cb[3]	12	16	18	28	5M	Chromang
Champion	Type 308	Type 309 Type 309Cb	Type 310 Type 310Cb Type 310Mo	Type 311	Type 316 Type 316Cb	Type 317	Type 329	Type 330	Type 347	Type 410	Type 430	Type 442	Type 446	Type 502	
Crucible Steel *Rezistal	KA-2-S	No. 3 No. 3Cb	No. 7	No. 4	KA-2SMo	KA-2SMo	No. 329	No. 330	KA-2-SCB	No. 12	No. 17	No. 20	No. 27	Lo Cro 46Mo.	Armorize Mn.
Harnischfeger *Harstain	18/8		25/20		18/12 2Mo	18/12 2Mo			18/8Cb			Harnichrome 16 Cr	Harnichrome 27 Cr	Harnichrome	AW-3C
Hollup *Sureweld	Type 19-9	Type 25-12	Type 25/20		Type19/9Mo	Type 19/9Mo		Type15/35	Type 19/9Cb	Type 12/14Cr	Type 16/18Cr			Type 4/6Cr	Armrod 307
Lincoln *Stainweld	A7	B	D		C	C	C		A5					Chromeweld 4/6	
Maurath	Type 304 Type 308	Type 309 Type 309Cb	Type 310	Type 311	Type 316 Type 316Cb	Type 317	Type 329	Type 330	Type 347	Type 410	Type 430	Type 442	Type 446	Type 502	
McKay	18/8	25/12 25/12Cb	25/20		18/8Mo	18/8Mo		15/35	18/8Cb	12 Cr	16 Cr	18 Cr	28 Cr	5 Cr Mo	Armorloy A-8 Armorloy 5-AM
Metal & Thermit *Murex	18/8		25-20 Type 310		18/8Mo	18/8Mo			18/8Cb Type 347						Stainless Mn.
Page *Allegheny	18/8 Type 308	25/12 Type 309	25/20 Type 310		18/8Mo Type 316	18/8Mo Type 317		15/35 Type 330	18/8Cb Type 347	12 Cr Type 410	16 Cr Type 430		23 Cr Type 446	4/6Cr Type 502	19/9 Modified Type 307
A. O. Smith	SW-162	SW-166 SW-167	SW-159		SW-160	SW-161			SW-157	SW-153	SW-154			SW-151	SW-164
Universal Power *Stainare	A (302-B) F	G (309Cb) H	L	I	C (316Cb) E	D	S	U	B	M	O	P	R	Y Z	
Wilson	19/9	25/12 25/12Cb	25/20		18/8Mo				19/9Cb					4/6Cr Mo	504

*Trade Name Used As Prefix. (1) Unless designated as Stainlend, Chromend prefix applies. (2) Both Stainlend and Chromend prefix apply.



DUCTILITY—STRENGTH—TOUGHNESS PUT N-A-X 9120 ON THE JOB

The track assembly parts of the amphibious Weasel call for something pretty special in *steel* to meet the requirements.

It must have *ductility* to permit cold-forming into difficult stampings. And it must have good *hardenability* and response to heat-treatment to make it strong and tough.

N-A-X 9120 combines these properties in one great steel, and provides in addition excellent weldability for the fabrication of the track shoe. Together, these track parts furnish a good example of the outstanding work being done with versatile N-A-X alloy steels. Consult Great Lakes for assistance in determining the best steel of this series for your particular requirements.

HEAT-TREATED TRACK ASSEMBLY PARTS COLD-FORMED OF N-A-X LOW-ALLOY STEEL

GREAT STEELS FROM GREAT LAKES

GREAT LAKES STEEL *Corporation*

N-A-X ALLOY DIVISION · DETROIT 18, MICHIGAN

UNIT OF NATIONAL STEEL CORPORATION

The Technical Slant

Books are the ever-burning lamps of accumulated wisdom—*G. W. Curtis.*

Safety Codes

NATIONAL FIRE CODES, *Vol. 1., Flammable Liquids, Gases, Chemicals and Explosives. Published by the National Fire Protection Association, Boston, 1945. Cloth, 6 x 9 in., 592 pages. Price $3.*

This volume deals with flammable liquids, gases, chemicals and explosives, whose fire and explosive hazards involve great danger to human life and property. Appearing at a time when war demands increasingly larger quantities of these dangerous materials, the book assembles for the reader's convenience the many standards dealing with these hazards. It supersedes the National Fire Codes for Flammable Liquids, Gases, Chemicals and Explosives for 1943. The new volume contains up-to-date information on new chemicals and solvents used in war industries, including information on their fire-hazard properties and the best methods of fire extinguishment. In addition, there are six new or revised codes.

The volume is divided into nine parts as follows: (1) flammable liquid storage and handling; (2) oil and gasoline burning equipment; (3) liquefied petroleum gases; (4) utilization of flammable liquids; (5) gases; (6) refrigeration and fumigation; (7) explosive and nitrocellulose materials; (8) table of properties—hazardous chemicals, flammable liquids; (9) flash-point tests.

The several codes are in the form of suggested ordinances, standards or recommended good-practice requirements. They are universally recognized and used as the authoritative guides to the best practice. Irrespective of their form, the codes are purely advisory as far as the N.F.P.A. is concerned. In preparing all standards, the aim of the N.F.P.A. committees has been to specify measures that will provide reasonable fire safety without prohibitive expense or undue inconvenience.

Of particular interest to the readers of this publication are those recommendations dealing with the use of acetylene and gas systems for welding and cutting. These in particular serve as a guide to good practice for gas weldors and flame-cutting operators.

» «

Management

BASICS OF SUPERVISION. *By H. W. Heinrich. Published by Alfred M. Best Company, Inc., New York 7, 1944. Cloth, 5¼ x 8 inches, 180 pages. Price $3.*

It was to be expected that H. W. Heinrich, who in his many writings on accident prevention has placed much emphasis on supervision, would sometime lend his analytical talents to the broad problems of supervision itself.

In "Basics of Supervision" the author has simply and convincingly done that which has long been held impossible. He has taken apart the vastly complex subject of supervision, identified its separate basic factors and arranged in orderly fashion the chain of elements connecting foremanship with safe and efficient production.

Attitudes, abilities, knowledge and action, says Mr. Heinrich, are the basic tools of industrial supervision. Under each of these four cardinal essentials of supervision is a further breakdown into four component fundamentals. The resulting chain of sixteen basic factors and their relations to one another are then explained one by one in simple narrative style.

Of the ten fairly short chapters, five are devoted to basic instructions and five to advanced training. The chapters deal with the promotion of efficiency, production and safety; how to give orders; how to maintain discipline; reasons and remedies for unsafe practices; how to check worker performance; how to train foremen; how to analyze people, etc. Each chapter is followed by a summary and review questions.

Step by step with increasing emphasis, details and examples, the text takes the reader through basic instruction to the dynamic or "active" part of the foreman's job. One wonders why so vitally important a subject as supervision was not treated in this simple fashion long ago. For all of its apparent complexities dissolve and disappear into the basic factors mentioned above.

» «

Foremen Selection

HOW TO SELECT FOREMEN AND SUPERVISORS. *By R. C. Oberdahn. Published by National Foremen's Institute, Deep River, Conn., 1944. Simulated leather, 5¼ x 8 in., 53 pages. Price $2.*

Managements confronted with the problem of selecting capable foremen will find the solution in the five chapters of this little book. Though designed to serve as a guide for formulating a selective program for foremen, the material is presented in such a manner that it is also of value to those seeking to become foremen—it provides a helpful means of self-evaluation.

The opening chapter defines a foreman; his duties are outlined in the next chapter. The two chapters which follow describe how foremen were once selected and how they are now selected. A detailed discussion is given of preliminary selection tests, establishing tests, character investigation and other pertinent steps leading to final approval. The final chapter summarizes the four preceding chapters and presents the author's conclusions.

One of the excellent features of the book is the fact that Mr. Oberdahn is looking ahead to the time when supervision will be more important than speed. This perspective makes his book one that should be seriously considered by all foremen and future foremen.

L. W. (Pop) TRAHAN Says

"ALL WELDERS IN OUR SHIPYARD USE THERMACOTE LENS AND GIVE THEM TOP RATING. WITH THERMACOTE LENS YOU CAN BURN THE RODS ALL DAY LONG AND NOT HAVE ANY TROUBLE WITH THE SPLATTER."

"Pop" Trahan has been welding since 1926. He worked three years as railroad boiler maker. For ten years he has been building ships for Levingston Shipyards, Texas. "Pop" knows the electric welding game from A to Z.

THERMACOTE CO.
NEWARK CHICAGO
PORTLAND LOS ANGELES

Dredge Pump Shells *Kept Going* by Build-Up Arc-Welding

The dredge pumps subjected to heaviest duty are usually fitted with austenitic manganese steel shells, for greatest resistance to shock-stresses from boulders, combined with a first class resistance to abrasive wear. Even manganese steel wears out, of course, and it is wise to rebuild eroded areas in a shell before a hole develops or pump efficiency is greatly reduced.

Pictures A-473 and A-474 show the rebuilding of the abraded interior of a manganese steel dredge pump shell by arc welding with Amsco Nickel-Manganese Steel Welding Rod. This material, as weld-metal applied to manganese steel castings, has properties comparable to the parent metal. It deposits in a uniform flat bead without porosity and with very little spatter or crater checks. When used to restore ordinary ferrous parts, the built-up portion offers greater resistance to impact and abrasion than the parent metal. The nickel content of the rod prevents embrittlement of the weld under air cooling and eliminates the necessity for quenching.

Picture A-216 shows the appearance of a pump shell interior rebuilt with Amsco electrodes.

Ask for Bulletin 941-W, which pictures and describes many profitable applications of Amsco welding products.

(Amsco Welding Products are produced and sold in Canada by Canadian Ramapo Iron Works, Inc., Niagara Falls, Ontario)

Amsco
AMERICAN MANGANESE STEEL DIVISION
Chicago Heights, Illinois
FOUNDRIES AT CHICAGO HEIGHTS, ILL.; NEW CASTLE, DEL.; DENVER, COLO.; OAKLAND, CALIF.; LOS ANGELES, CALIF.; ST. LOUIS, MO.
OFFICES IN PRINCIPAL CITIES

AMERICAN
Brake Shoe
COMPANY

New Products

(Continued from page 68)

Hard-Facing Rods

★ Three new hard-facing products are announced by Mir-O-Col research engineers. "Mir-O-Col No. 3" and "Mir-O-Col No. 4" electrodes are both classified in the low-alloy group of hard-facing materials, for arc welding only. No. 3 is a work-hardening ferro-alloy with very high resistance to shock and impact and work-hardening qualities. It is to be used for hard-facing parts of heavy equipment where unusually thick deposits are required. No. 4 has a carbon-steel core, with the alloying elements in the flux coating. It is resistant to both abrasion and impact.

Replacing this manufacturer's former "Valvrod," the new "Mir-O-Col No. 6" rod is an alloy of nickel, molybdenum and chromium, especially designed for hard-facing all types of valves, including high-pressure steam and chemical products valves, automotive and various pump valves and valve seats. It is characterized by high red hardness, corrosion resistance, and resistance to impact, spalling and abrasion. It is a non-magnetic rod with an austenitic grain structure and can be deposited by either the arc or the oxy-acetylene method. **Mir-O-Col Alloy Co.**, 2416-60 E. 53rd St., Los Angeles 11.

» «

High-Tensile Electrode

★ Murex "Type HTS" is a mineral-coated electrode with a less penetrating arc than so-called "hot rods." It produces a weld deposit of high tensile strength with the ductility and X-ray soundness of metal deposited by down-hand electrodes.

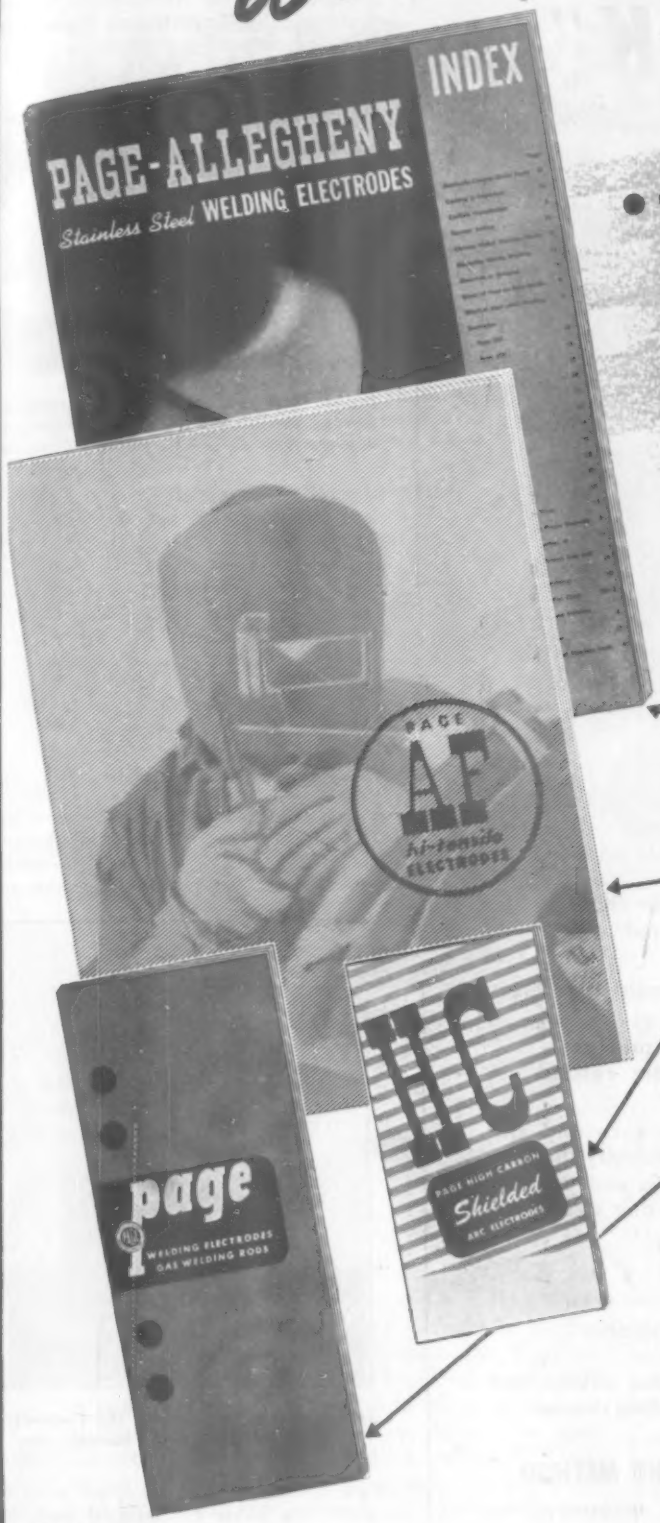
This new electrode was primarily developed to prevent underbead cracking in the welding of high-tensile steel plate such as that used for certain classes of ship construction. Because it minimizes pick-up of undesirable elements from the parent metal and prevents cracking and porosity in the weld, it is also being found useful in welding "dirty" steels as well as for welding cold-rolled, high-carbon and high-sulphur steels and free-machining steels used for mechanical molds. In some applications, manufacturer states, it is being used successfully in place of more expensive stainless-steel electrodes. **Metal and Thermit Corp.**, 120 Broadway, New York City 5.

» «

Chrome-Moly Electrode

★ "Chromend 9-M" is an alloy electrode producing a weld deposit of 8 to 10% chromium, 1.5% molybdenum. It bridges the gap between Arcos "Chromend 5-M," a 4-6% chrome-moly electrode, and "Chromend 12," a 12% chrome-moly electrode. The new electrode is said to provide for greater strength and greater corrosion resistance combined with high creep resistance for high-temperature corrosion resistance work. **Arcos Corp.**, 1515 Locust St., Philadelphia 2.

PAGE *Welding* ELECTRODES



...YOURS FOR BETTER WELDING

•The three booklets and the leaflet shown here are for everyday use. Their purpose is to give welders up-to-date information on the selection of electrodes for specific jobs and how to use them to get best results.

DH-1023—If you are welding stainless steel, this 24-page booklet will be of value to you. It is almost a textbook on stainless steel electrodes and their proper use.

DH-936—This booklet is much more than a description of PAGE AF Hi-Tensile Electrodes. It is a comprehensive illustrated manual on their use.

DH-1174—This is a leaflet which describes the physical, chemical and working characteristics of the PAGE High Carbon Shielded Arc Electrode. It also lists a few of its many applications.

DH-821—Probably the most all-around useful booklet of all. It is a pocket-size catalog, arranged so that the recommended electrode or gas welding rod for any one of 28 classes of production welding can be found immediately.

★ ★ ★

Ask your nearest PAGE distributor for copies of one or more of these informative pieces. Or, if you prefer, write direct to the PAGE factory at Monessen, Pennsylvania.

ACCO

Monessen, Pa., Atlanta, Chicago, Denver, Los Angeles, New York, Philadelphia, Pittsburgh, Portland, San Francisco, Bridgeport, Conn.

PAGE STEEL AND WIRE DIVISION
AMERICAN CHAIN & CABLE

ACCO TRADE MARK

THE "MISSING LINK"

"A chain is no stronger than its weakest link." That's self-evident. But what happens if an entire link is missing? Naturally, the chain doesn't function at all.

60 Kva. BH Type Induction Heater with automatic heat recording and controlling equipment

Preheating may be the one missing link in your chain of welding operation that causes you to miss out. Don't neglect this important link to good results.

Your welding job is no better than the heat treatment it receives, both before and after welding.

If you select Low Frequency Induction pre- and post-heating equipment, you assure dependable results and absolute control in this important link.

The Smith-Dolan System provides maximum convenience and efficiency in Induction Heating. It is now meeting successfully the long felt need for a combination shop and field heating unit to bring dependability to the welding of alloy and high carbon steels.

Whether the welding job involves:

High pressure steam lines . . .
or
The propeller shaft of a fighting ship . . .
or
Pre- and post-heating of boiler drums and plates when automatic arc welding is used . . .
. . . or any other important job . . .

THE RESULTS JUSTIFY THE SELECTION OF THIS METHOD

Wherever controlled deep heating penetration is necessary, the Smith-Dolan System is the choice.

Our experience is at your service. Let us show you how pre-heating and normalizing can make a better welding job for you.

ELECTRIC ARC INC.

152-162 Jelliff Ave. Newark 8, New Jersey

Also manufacturers of

Arc Welders—Gasoline and Diesel Driven—Power Units—A. C. Welders

Recording Densitometer

★ An electrically operated densitometer that automatically computes a true logarithmic graph of its findings has been developed by **Triplett and Barton, Inc.**, Burbank, Calif. It completes in thirty

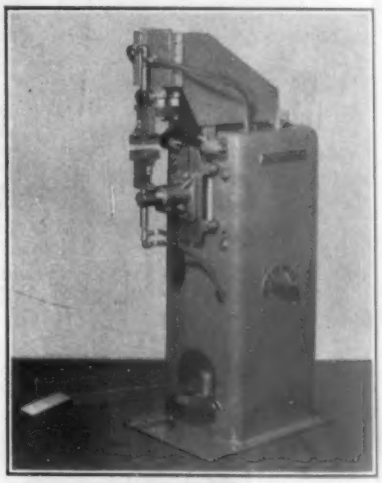
Triplett and Barton densitometer. Automatic plotting saves labor, makes possible a more accurate graphical representation of the data.

seconds a permanent curve that formerly required a number of individual hand operations and involved the risk of human error. It is said to be particularly valuable for detecting variations in photographic or radiographic film. It is designed to read densities of from 0 to 4.0—twice the density range of any other apparatus.

» «

Spot Welder for Cable

★ Thomson Model C, a 14 kva spot welder is equipped with special clamping dies and a special head for the cutting, welding and shaping of wire cable in a



Thomson cable spot welder. The electrodes are equipped with special clamping dies.

single operation. As the upper head descends, the cable is clamped and held firmly by the stationary half of the dies; the other half continues to move downward, stretching the cable. The welding current is applied, and all of the cable strands are welded together at the instant the cable is being stretched to the breaking point. The finished cable ends are thus welded and flattened as wanted. **Thomson-Gibb Electric Welding Co.**, Lynn, Mass.

A COMPLETE NEMA 3B SEQUENCE PANEL

NATIONAL

DUO-TROL

WELD TIMER • *Type* 1841P

Right: Duo-Trol Fully Enclosed in steel cabinet Dial Knobs Protected by overhanging Cover.

Simple
Light in Weight
Accurate Compact

Duo-Trol viewed from right end showing Simple Electro-mechanical Heat Control Device on motor end. Here's a Timer an Operator can Service—and see what is really going on.

ACCESSIBLE, with FULL VISIBILITY FOR EASY SERVICING

When Cover is lifted off, the entire Control is fully exposed . . . Exclusive NATIONAL Cam Control for precision and efficiency—used by a wide range of manufacturers.

DUO-TROL is a combination of the National Weld-Timer, the Leader in Mass Production Industry,—and Heat Control—frequently called Delayed Firing—which varies the amount of Heat permitted to flow through the Welding Transformer Primary—Plus Finger Tip Dial Setting of Weld-Time and Heat. . . . It was introduced to satisfy the rigid Qualification requirements of the Army, for spot welding of critical alloys, such as stainless steel and Alclad, in which it has proved itself without superior, in performance. . . . In this work, the presence of setting dials was quite essential. The character of metal was such that slight changes were frequently called for. In many instances, Power Supply voltage went up and down. Still, all welds had to be exactly the same. Weld-Time was usually 2 cycles or less. One-half cycle more or less represented a 25% change, which was excessive. With Heat Control this value is divided into no less than 30 increments, thus providing a vernier-like adjustment to insure uniformity. . . . With DUO-TROL, over the total weld range, usually 12 cycles, it is possible to obtain at least 600 different settings for each Primary Transformer Tap. . . . In Post War, Industry will continue to use critical alloys, that require Precision Vernier Setting Welding Controls.

DUO-TROL will continue to be First choice for these operations.

NATIONAL TIME & SIGNAL CORPORATION

600 E. MILWAUKEE AVENUE DETROIT 2, MICHIGAN

News of the Industry

WPB Appoints 400 Reconversion Heads

Appointment of reconversion chairmen for approximately 400 industries including welding was announced by a War Production Board Committee headed by John D. Small, WPB chief of staff. This move is in line with WPB's announced intention of facilitating the changeover from military to civilian production whenever it can be done without detriment to the war effort.

H. R. Smith is reconversion chairman for the three welding industries: welding equipment and apparatus, electric; welding equipment and apparatus, non-electric; welding rods and electrodes for arc and gas welding. Mr. Smith is also chief of the arc, gas welding and cutting equipment section of WPB's welding equipment branch.

» «

Raise Farm Priorities for Welding Equipment

Farmers were last month given an AA-2 extendable preference rating by the Office of Civilian Requirements for obtaining necessary farm equipment including welding outfits. Arc welders costing less than $75, welding rods and electrodes are included among the revised list of items to which the AA-2 rating can now be applied.

Other changes made by the amended priorities regulation for farm supplies eliminate the necessity for approval of county farm rationing committees of purchases in excess of $50 and eliminate the "basketing" provision that permitted a dealer to apply all farmers' applications toward the purchase of any selection of items he might choose.

The amended order states the procedure to be followed in case of emergency as follows: "In emergencies, where a farmer needs a special priority to get repairs or supplies to fix something that is broken down or about to break down, he can tell this to the nearest WPB field office by letter, telegram, telephone or personal visit. If the need is really urgent, and the repair or supply item is of a kind that WPB can give a priority for, the field office may give the farmer a priority up to AA-1, and will tell him how to use it."

» «

AAF Tests and Approves Battery-Powered Welders

Official certification of battery-powered resistance-welding equipment for the spot welding of aluminum sheet was recently issued by the Air Technical Service Command, Army Air Forces, following welding tests in two-sheet and three-sheet thicknesses.

The tests were conducted on 24 ST Alclad in the gauge combinations of 0.051 in. to 0.051 in. and 0.051 in. to 0.083 in. to 0.051 in. A rocker-arm aluminum spot welder powered by a standard 16 cell storage battery power-pack was employed. Shear strength of the spots was found to be consistently above the minimum required by the Air Force specifications. Radiographic inspection revealed no apparent defects, while microscopic examination showed good symmetry and uniformity.

The certification (No. RW-185-P-2) was issued in connection with authorization to use battery-powered welders for the assembly welding of wing flaps for P-38's.

» «

New Mir-O-Col Distributor

The R. C. Brown Welding Supply Co. has been appointed a distributor of Mir-O-Col hard-facing products for the Pomona district of eastern Los Angeles county.

BALANCED POLARITY
GIVES
THOROUGH
PENETRATION
and
NO MAGNETIC BLOW
MARQUETTE
REGISTERED U.S. PAT. OFFICE
A.C. ARC WELDERS
with a
SINGLE
ROD
The unbeatable combination of Thorough Penetration and Perfect Arc Control, both at the same time and with a single rod, is yours with Marquette A.C. Arc Welders. No question of straight or reversed polarity. Always the same accurately regulated, matchless welding power. The complete absence of "Magnetic Blow" saves time and tempers, especially when working in close quarters.
Cast iron, malleable castings, aluminum, in fact, every size and type of metal, no matter what the job, Marquette A.C. Arc Welders will turn out strong, dependable, good looking welds faster and at less cost.
PRODUCTION or MAINTENANCE
Marquette's ease of operation, simplicity and dependability is reflected in Speeded-up Production because the operator can concentrate on the job without having to bother with confusing levers, dials and gadgets. A Marquette Welder is indispensable in Maintenance for both quick, dependable repairs on vital machinery and for general construction of racks, frames, jigs, dies, etc.
10 Models, 125 to 400 Amps.
Completely Equipped
Send for free 24 page illustrated booklet
BUY THE BEST —
BUY MARQUETTE
MARQUETTE
REGISTERED U.S. PAT. OFFICE
MARQUETTE MFG. CO., Inc.
Minneapolis 14, Minnesota
WELDING
Equipment
ELECTRODES AND SUPPLIES

FOR HIGHER RATINGS AND LONGER CONTACT LIFE

SQUARE D SYNCRO-BREAK RESISTANCE WELDER CONTACTORS

Arcing is eliminated at the contact tips of *SYNCRO-BREAK* contactors by separately energizing the magnet "shading coil" from a transformer and rheostat circuit. Correct rheostat adjustment causes the contacts to part as the alternating current wave approaches zero. Thus, the contactor interrupts zero current and no arc is drawn.

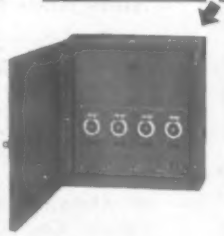
Elimination of arc heat at contacts increases allowable ratings and contact tip deterioration is reduced substantially. Rheostat adjustment is not critical and synchronization remains stable over long periods of usage.

Among the important mechanical design features which assure long, trouble-free service are: Hardened, knife-edge bearings for long life without lubrication. Solid contact supports to conduct away heat and relieve contact studs from impact strain. Low inertia moving parts and short contact gap, permitting consistent high-speed operation.

FOR FULLY AUTOMATIC CONTROL OF RESISTANCE WELDING MACHINES

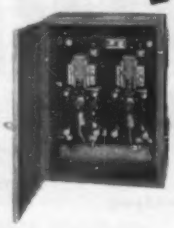
Use Safront Weld or Sequence Timers with SYNCRO-BREAK Contactors or HIGH-SPEED Contactors

Available in 18 NEMA standard types with separate pneumatic timing relays for each step of the welding cycle. All electrically energized parts are placed behind a protective panel. Calibrated timer dials are adjusted from the front.



Notice attractive new flat-door cabinet construction which harmonizes with Safront timers. This design allows more interior wiring space without increasing overall outside dimensions. Syncro-Break contactors are single pole only.

Available in either single or double pole, employing the same contactor construction as the Syncro-Break. High-Speed contactors without the synchronizing circuits are applied where operation is less frequent and loads are lighter.



SQUARE D COMPANY

DETROIT • MILWAUKEE • LOS ANGELES

Weldors' Gloves Put under Control of WPB

A shortage in the type of leather used for weldors' gloves has caused this product to be placed under control of the War Production Board. The sale of new weldors' gloves by manufacturers or dealers for resale is now prohibited (Direction 1 to Conservation Order M-375) except on rated orders bearing a certification that the gloves will be sold only for use in welding operations. A dealer selling weldors' gloves to a consumer is also required to satisfy himself that the latter will use the gloves for welding operations, but he is not compelled to demand a written statement to this effect from the purchaser.

Our Front Cover

The pictures making up the front cover montage should be credited as follows:
Upper left, American Bridge Company.
Left center, Lockheed Aircraft.
Lower left, official Signal Corp photo.
Upper right, Warren City Mfg. Company.
Right center, Glenn L. Martin Company.
Lower right, Official Navy photo.

Free Aluminum for Civilian Use

Aluminum producers were last month authorized by the War Production Board to fill non-priority orders of civilian goods manufacturers whenever they do not interfere with the delivery of orders with priority ratings. Steel and copper were also to be released in similar fashion.

WPB said that its decision would make "large quantities" of aluminum immediately available for consumer goods. Estimates on the freed supply ranged from 100 million to 300 million pounds annually, depending on the extent of military cutbacks.

» «

General Electric Plans New Research Laboratory

A new building for the General Electric Company's research laboratory will be erected about 4½ miles from the main plant at Schenectady as soon as WPB approval can be obtained. Costing an estimated $8,000,000, the new building will afford some 50% more space than present facilities provide.

The site picked overlooks the Mohawk river and is on a rocky cliff which will afford a solid foundation. The new building will vary from two to five stories high and will include 200,000 sq ft of laboratory working space in addition to an auditorium, dining room and conference rooms. One third of the laboratory space will be devoted to service facilities, machine shops and specialty shops such as glass blowers. Walls between rooms will be movable, capable of being placed at 18 in. intervals so that a room may be made as large or as small as desired. The building will be air-conditioned throughout and interlaced with wires and pipes carrying various kinds and voltages of electricity, compressed air, suction, hydrogen, oxygen, etc.

» «

Colonial Tanning Acquires Important Leather Supply

Arrangements have been made for the Colonial Tanning Co., Boston, to merchandise a part of the production of the Leach-Heckel Leather Co., Salem, Mass. This tannery, with modernized equipment and sufficient manpower, is capable of producing well over a million feet of leather per month. The part of its output which Colonial Tanning will handle is expected to consist mostly of split leathers.

» «

Alloy Rods Distributors

Alloy Rods Co., York, Pa., has made four recent appointments for the distribution of "Arcaloy" stainless-steel and "Tool-Arc" tool-steel electrodes. These are: the Post Welding Supply Co., 613 North Ninth St., Birmingham, Ala., as exclusive distributor for the entire state of Alabama; the Ft. Worth Welding Supply Co., 2228 North Main St., Ft. Worth, Tex., as exclusive representative for the north and western sections of Texas; Kirk-Wiklund & Co., 1704-6 Baltimore Ave., Kansas City, Mo., as exclusive distributor for the eastern half of Kansas and western half of Missouri; the William L. Oaks Machinery Co., 320 North Morgan St., Decatur, Ill., as exclusive distributor for the central section of Illinois.

Easy-Handling

SKILGRINDER...

Smoothest Performer on Bead Grinding Jobs

• Built with powerful, smooth-running motor for high load speed . . . ball bearings in steel inserts on armature and extreme end of wheel spindle shaft to absorb thrust and eliminate vibration . . . commutator, brushes and switch fully enclosed against dust for longer, trouble-free service. Ask your distributor today for a demonstration.

SKILSAW, INC.
5033-43 Elston Ave., Chicago 30, Ill.
Factory Branches in All Principal Cities

PORTABLE ELECTRIC
SKILTOOLS
MADE BY SKILSAW, INC.

PLANNING RETOOLING AFTER-THE-WAR?

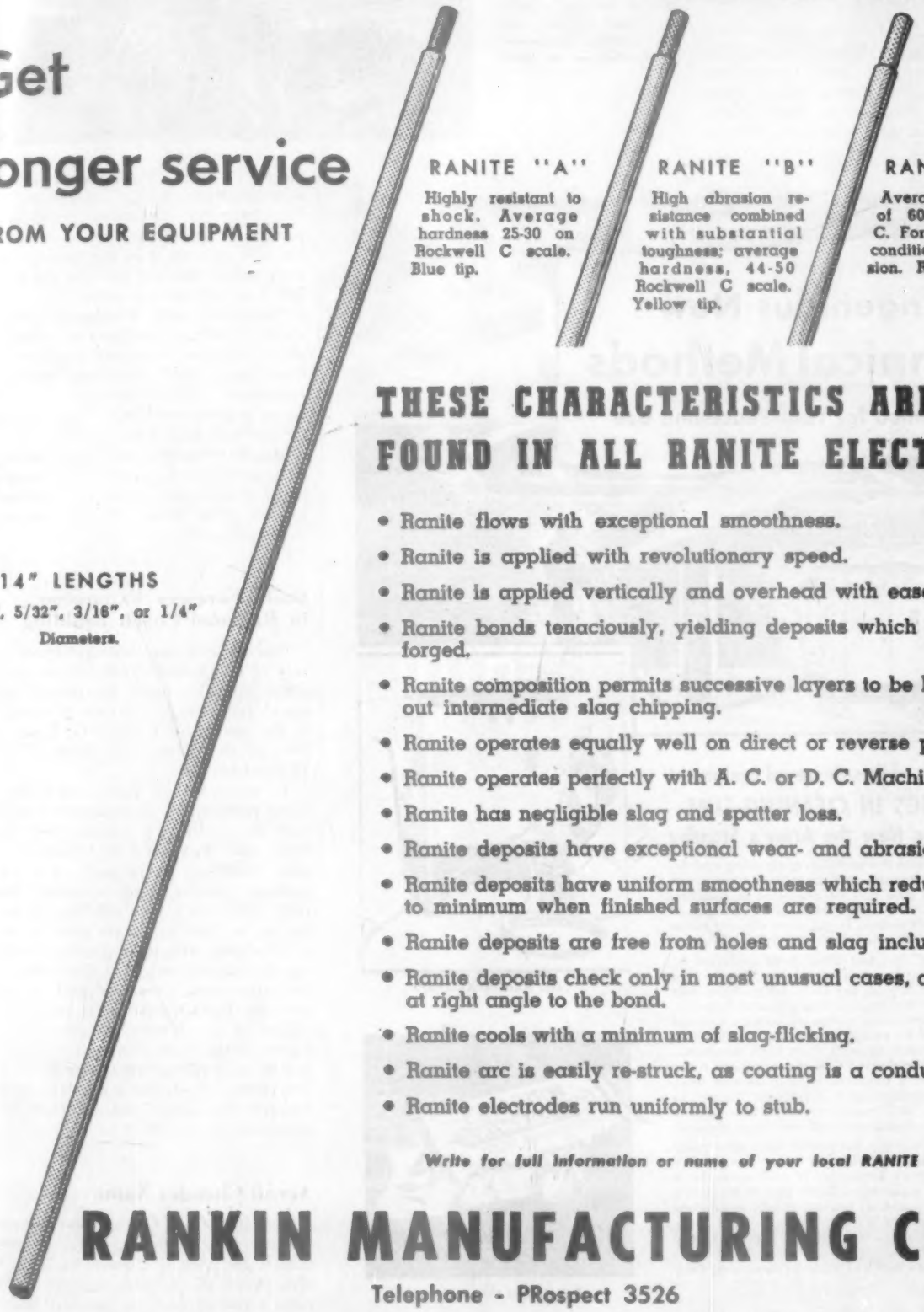
Let SKILTOOL Field Engineers help you now to plan "tooling-up" for more efficient and economical peacetime production with SKILSAW'S new postwar tools.

HARD-SURFACE

with Smooth-flowing RANITE

Get longer service

FROM YOUR EQUIPMENT



RANITE "A"
Highly resistant to shock. Average hardness 25-30 on Rockwell C scale. Blue tip.

RANITE "B"
High abrasion resistance combined with substantial toughness; average hardness, 44-50 Rockwell C scale. Yellow tip.

RANITE "C"
Average hardness of 60-62 Rockwell C. For most severe conditions of abrasion. Red tip.

14" LENGTHS
1/8", 5/32", 3/16", or 1/4" Diameters.

THESE CHARACTERISTICS ARE FOUND IN ALL RANITE ELECTRODES

- Ranite flows with exceptional smoothness.
- Ranite is applied with revolutionary speed.
- Ranite is applied vertically and overhead with ease.
- Ranite bonds tenaciously, yielding deposits which may be hot-forged.
- Ranite composition permits successive layers to be built up without intermediate slag chipping.
- Ranite operates equally well on direct or reverse polarity.
- Ranite operates perfectly with A. C. or D. C. Machines.
- Ranite has negligible slag and spatter loss.
- Ranite deposits have exceptional wear- and abrasion-resistance.
- Ranite deposits have uniform smoothness which reduces grinding to minimum when finished surfaces are required.
- Ranite deposits are free from holes and slag inclusions.
- Ranite deposits check only in most unusual cases, and then only at right angle to the bond.
- Ranite cools with a minimum of slag-flicking.
- Ranite arc is easily re-struck, as coating is a conductor in itself.
- Ranite electrodes run uniformly to stub.

Write for full information or name of your local RANITE Distributor.

RANKIN MANUFACTURING CO.

Telephone - PRospect 3526

1403-05 West Washington Blvd. Los Angeles 7, California

G.I. Loan Sets up a Welding Business

Martin Friedmann, Jr., was granted the first loan in Tidewater, Va., under the G.I. Bill of Rights. There never was any question about what he intended to do. Said Friedmann, who has been a weldor for many of his 36 years: "Since welding's the thing I know the very best, it is only natural that I should return to it after leaving the Army."

The ex-soldier used his loan to construct a peripatetic welding shop on wheels. The chassis is a 1½ ton 1945 truck. The fenders, on which much of the work will be done, were homemade from 3/16 in. plate. Across the rear is a 1 in. plate with a big vise, to act as a bench. The truck contains a 300 amp gas-driven welder, oxygen and acetylene cylinders, two-stage regulators, an assortment of cutting and welding torches for tasks ranging from the cutting of heavy plate to lead burning, 250 ft of gas hose and 500 ft of 1/0 welding cable.

This is ex-G.I. Martin Friedmann, Jr., of Tidewater, Va. and his portable welding shop on wheels. The shop was made possible by a loan granted under the G.I. Bill of Rights for the purpose of starting in business. Both electric and gas welding equipment are carried on the back.

The loan, said Friedmann, was put through with a minimum of delay, after which priorities were used to obtain a new truck upon which to mount the welding equipment. "There seems to be quite a bit of welding work here, and I'm looking forward to a busy time," he adds.

Mr. Friedmann's wife will answer the telephone. She is a weldor, too—taught by her husband—and so is well equipped to talk over the details of the various jobs with customers.

» «

Budd Foresees Expansion in Railroad Coach Building

Postwar railroad passenger travel at the rate of approximately 48 billion passenger miles annually—twice the prewar rate of travel in 1940—is a conservative estimate in the opinion of Edward G. Budd, president of the Edward G. Budd Mfg. Co., Philadelphia.

To carry such a volume of traffic, Mr. Budd pointed out, the railroads have about half the number of coaches they had in 1920, when they did a 47 billion passenger mile business. To properly care for the postwar traveler, Budd estimates that at least 2,637 cars a year will have to be built during the first five years after the war.

In keeping with its program of undertaking the manufacture of a diversified group of streamlined stainless-steel passenger cars, the Budd company has completed the design of an all-room sleeping car to be known as the "Cabin Car." This is a standard 85 ft sleeper divided into 22 commodious rooms, all on one level. The beds are lowered into place and returned to day positions electrically.

» «

Aeroil Changes Name

Aeroil Products Co. has been adopted as the new name of the organization formerly known as "Aeroil Burner Co." of West New York, N. J. This concern manufactures a line of oil-fired, gas-fired and electrically heated industrial equipment, including preheating torches.

Coming to Users of Gas-Powered Equipment

80% SAVINGS IN CLEANING TIME

With Steam Rig Now the Army's Standby

An economical solution to the problem of cleaning and degreasing trucks, passenger cars, tractors, locomotives, excavators, and the like will be available to garages, service stations, all users of oil-burning equipment, as soon as war demands permit. It is a more efficient steam cleaner now in use by the thousands in the Armed Forces.

Neat "housekeeping" has too often been neglected by industry due to the costliness of hand labor. But the best housekeepers in the World, the U. S. Army, Navy and Marine Corps, dare not neglect frequent and thorough cleaning of all equipment to safeguard against fire and malfunctioning, and to permit fast, certain inspection. This cleaner, developed to meet their high standards, removes grease, dirt and grit 5 times as fast as any other method. It cleans by a balanced combination of heat, detergent, water and friction. It is typically "army" in simplicity of design and operation; in 30 minutes, the entire machine can be dismantled and completely cleaned.

Wartime uses of Wrigley's Spearmint Gum also point the way that industry may benefit when this quality product again becomes available. It will *again* be a "help on the job" in many ways. Right now *no* Wrigley's Spearmint is being made, as present conditions do not permit the manufacture of Wrigley's Spearmint in quantity and quality sufficient for all. But remember the Wrigley's Spearmint wrapper—it is a certificate of highest quality and flavor—and will always remain just that.

You can get complete information from Clayton Manufacturing Company, Alhambra, Calif.

The Kerrick Kleaner

Remember this wrapper

Z-74

TOOL OF THE MONTH

ATLAS TOMAHAWK

Model Number 3

Featuring ENDURO Hardened Heads; Chipping Faces at right angles to each other. Wooden Hand Grip.

Available in 12 or 16 ounce weights.

Six other models of Tomahawks to choose from.

The Most Complete Line of Weld Cleaning Tools on the Market

UNIVERSAL TOMAHAWK
"Standard" and "Heavy-Duty" weights

SYMBOL HAMMER
for welder identification

DUAL-TOOL MODEL A

DUAL-TOOL MODEL B

TOMAHAWK MODEL NO. 1
"Standard" and "Heavy-Duty" weights

TOMAHAWK MODEL NO. 4
"Standard" and "Heavy-Duty" weights

CLEANING BRUSH
featuring "Grip-Tight" Brush Holder

TOMAHAWK MODEL NO. 3
"Standard" and "Heavy-Duty" weights

MAHAWK DEL NO. 2
ndard" and eavy-Duty" weights

Engineered Tools of Perfect Balance, Correct Weight; ENDURO Hardened

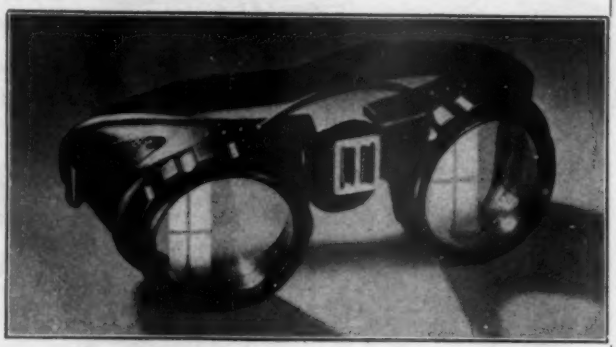
YOUR DEALER will be glad to recommend the ATLAS Weld Cleaning Tool best adapted to your requirements.

ATLAS WELDING ACCESSORIES COMPANY

14820 Wyoming Avenue — Detroit 21, Michigan

METRO'S
NEW
BLACK
Chipping and Grinding
GOGGLE

Presenting the Third
OF METRO'S SAFETY "6" SERIES



METRO'S
BLACK
Chipping and Grinding
COVERALLS

Metro Manufacturing Co. Long Island City 1, N. Y.

SUPER–WETTING
KWIKFLUX
SPEEDS PRODUCTION

Fast Flowing . . . No Lumping or Pitting of Solder
MEETS ALL RIGID SPECIFICATIONS

KWIKFLUX accomplishes 25% to 50% higher wetting action than the fluxes now on the market, and has almost 100% higher penetration in deep joints. It works perfectly with direct gas flame, hydrogen, acetylene —Muffle (direct or indirect) and induction heating. KWIKFLUX is used for brazing, hard soldering and welding of Stainless Steel, Iron, Copper, Brass, Bronze, Platinum, Gold, Silver, Monel Metal, Nickel, German Silver and other ferrous or non-ferrous metals and alloys. It will not blacken brass or copper, and is suited to either automatic or manual operations. Fast, efficient action assures improved quality and finish.

TESTED AND PROVEN BY PROMINENT USER OF FLUXES
"KWIKFLUX has proven far superior to other fluxes due to the ease with which the excess material may be removed after brazing, that it is also necessary to use very much less quantity, and that it is much easier on the eyes, throat and hands." (Name on request)

WRITE FOR LITERATURE
Data sheets describing KWIKFLUX in detail — advantages, properties, characteristics and price—will be sent promptly on request. There is no obligation.

OUR NEW 1945 PRICE SCHEDULE PLACES KWIKFLUX ON AN ALL-INCLUSIVE COMPETITIVE BASIS

Advantages:
(1) Perfect with both Low and High Melting Point Hard Solders.
(2) Excess Flux washes off clear in hot water —saves cleaning and finishing time.
(3) Does not lump or pit solder. Forms smooth film easily washed off, leaving surface beneath bright and shiny.
(4) Faster, Fluxing Actions—saves time, gas and electricity.
(5) Fumes are fixed because KWIKFLUX is neutral. Increases production efficiency.

SEND FOR FREE TRIAL JAR
For more than 12 years, our tested research improvements have been passed on to our customers. This service has been in operation during the war period.

KWIK FLUX

SPEC
SPECIAL CHEMICALS CO.
30-36 IRVING PLACE, NEW YORK 3, N. Y.

Welding Stands First on OPRD Project List

Evidence of the growing importance of welding to postwar industry is afforded by a recent list of wartime developments beneficial to peacetime civilian industry, compiled by the Office of Production Research and Development of the War Production Board. Welding research stood first on the list.

"Welding research projects," declared OPRD, "have helped maintain American aircraft superiority, and the knowledge gained will be carried into postwar construction. Construction requirements now conform more closely to their calculated requirements. Thus weight formerly required by the additional metal necessary to meet the safety insurance factor has been converted to additional carrying capacity."

Among the other projects mentioned as having great postwar value to the public were: improvement in the weldability of high-strength, low-alloy steels—an accomplishment important to the transportation industry—and a new fluoroscopic-inspection method for metals that reduces X-ray film consumption and saves man-hours.

» «

Ergolyte Names Six Jobbers

Six additional jobbers, doing business in eight different states, have been appointed to handle the arc welders and other products manufactured by the Ergolyte Manufacturing Co., Philadelphia. The new jobbers are: Pleasantville Motor Parts Co., Pleasantville, N. J.; Liss Equipment, Miami, Fla.; Hunt Automotive Supply Co., Norfolk, Va.; J. M. Dalgish & Co., St. Paul Minn.; Absco Welded Products, California, Oregon, Washington and Arizona; American Welding Supply, Paterson, N. J.

ABOUT PEOPLE

W. Spraragen, editor and business manager of the *Welding Journal,* has been appointed to the newly created position of director of the Welding Research Council of the Engineering Foundation. He is at present executive secretary of the Council, a body sponsored jointly by the American Welding Society and the American Institute of Electrical Engineers. An important duty assigned to Mr. Spraragen in his new post will be the administration of the work of the newly organized Pressure Vessel Research Committee, which contemplates the expenditure of $225,000 in this field over a three year period.

» «

John W. Lohnes, formerly assistant general manager of sales, Vanadium Corp. of America, has been appointed Chicago district sales manager, succeeding the late **Le Roy F. Johnson.** His headquarters will be in the Field Building, 135 S. La Salle St., Chicago.

A FAT HOT Spark

THE *FIRST* TIME *EVERY* TIME

WITH THE Meco TRIPL-FLINT LIGHTER

Self-Laudation is rarely convincing . . . but the opinion of others is not to be ignored

Modern Engineering Co.
St. Louis, Missouri

Gentlemen:

We are unable to obtain thru our local company either Meco Lighters or renewal flints. Is it possible for me to get these direct from you?

My two helpers and myself have always used this . . . lighter and prefer it to any other make. If possible send price list.

Respectfully,
**J. B. H.*
Welder Operator
. . . . . Railroad Co.
L. . . . . , Indiana

**Original letter on request.*

The Meco Tripl-Flint Lighter has been designed and constructed to withstand hard wear and hard usage. It will serve a long period of useful life. It is the one *really* heavy duty lighter, no wires or springs . . . the lighter that will ignite any type of gas under even the most adverse conditions — high winds, moisture, rain, snow or sleet.

It is the only lighter equipped with three large flints, as a *part* of the lighter itself. This provides for renewal in a few seconds of time — a coin or any piece of flat metal will operate the set screw to rotate a new flint into position.

Most important, the Meco Tripl-Flint Lighter embodies the engineering details consistent with the outstanding design, construction and pioneering developments of *all* Meco Equipment. This 50c article is typical of Meco quality in *all* Meco Oxyacetylene Welding and Cutting Equipment.

Welding and Cutting Equipment

MODERN ENGINEERING CO.

3413 PINE BOULEVARD **ST. LOUIS, MISSOURI**

Now! splice your WELDING CABLE

Easily — Quickly — without Soldering or Rigid Connections

with the

PUNCH-LOK

Streamlined

BANDING METHOD

Punch-Lok Clamp

Loking Tool

Punch-Lok Clamps and Loking Tool will splice that broken cable. You can tie, reinforce, connect, mend and make scores of other applications. Easy, fast, safe, economical. No normal pull strain can tear it loose. Punch-Lok Method will save you time and money.

Write for descriptive catalog and name of nearest distributor.

KEEP BUYING WAR BONDS

PUNCH-LOK COMPANY

Dept. E, 321 North Justine Street, Chicago 7, Illinois

SALVAGE YOUR WORN TOOLS and DIES

THIS ECONOMICAL WAY

EVERY tool and die shop executive should be familiar with the arc welding procedures which have been developed for the maintenance, salvage and construction of forming, stamping, forging and blanking dies with PHILLIPS Crucible Arc Welding Electrodes. These electrodes can be used on carbon and alloy steels, water, oil and air hardening steels.

By following the procedures described in this new maintenance manual you can repair and salvage a very large percentage of your worn or defective dies, and at a very small fraction of the cost of replacement. Complete information is furnished with regard to characteristics, physical properties, application procedures and heat treatment temperatures for each electrode. You will want to add this vital maintenance data to your shop library.

THIS BOOK TELLS HOW

This manual contains valuable information for your tool conservation program. Send for your copy TODAY.

C. E. PHILLIPS & COMPANY

2750 Poplar Street, DETROIT 8, MICH.

332 S. Jefferson St., CHICAGO 6, ILL.

MANUFACTURERS AND DISTRIBUTORS OF WELDING ELECTRODES AND SPECIALTIES

Forest W. King has been appointed works manager at the Warren City Mfg. Co., Warren, O., subsidiary of Graham-Paige Motors. Mr. King joined the company eight months ago and served as master mechanic until his promotion to this post. He was formerly master mechanic at Willys-Overland Motors, Inc., and prior to that he was associated with the Libbey-Owens-Ford Glass Co. in the fields of engineering, development and methods.

» «

Carl B. McLaughlin will head the recently established engineering service division of Tube Turns, Inc., Louisville, Ky. This division is developing new applications for welding fittings. Mr. McLaughlin was formerly associated with Tube Turns' Pittsburgh office. Before joining the company in 1943, he was a metallurgist-engineer with the U. S. Steel Corp.

» «

William G. Bostwick, until recently chief electrical engineer of Federal Machine and Welder Co., Warren, O., has joined Precision Welder and Machine Co., Cincinnati, as chief electrical engineer.

» «

Frank C. Hasse, general manager of The Oxweld Railroad Service Co., a unit of Union Carbide and Carbon Corp., has been elected vice-president. He has been associated with Oxweld since 1913, prior to which he had a long career in the railroad industry. He is a member of the American Welding Society and has been prominent in the promotion of education and training in oxy-acetylene welding.

» «

Harvey W. Smith, electrical engineer specializing in transformer design, has joined the engineering staff of the Glenn-Roberts Co., Oakland, Calif. He will head research and development activities.

» «

E. O. Paullin has been appointed factory representative and welding engineer in Detroit for Una Welding, Inc., Cleveland. Mr. Paullin will have headquarters in the Statler Hotel and be available Monday through Friday for the discussion of arc-welding problems.

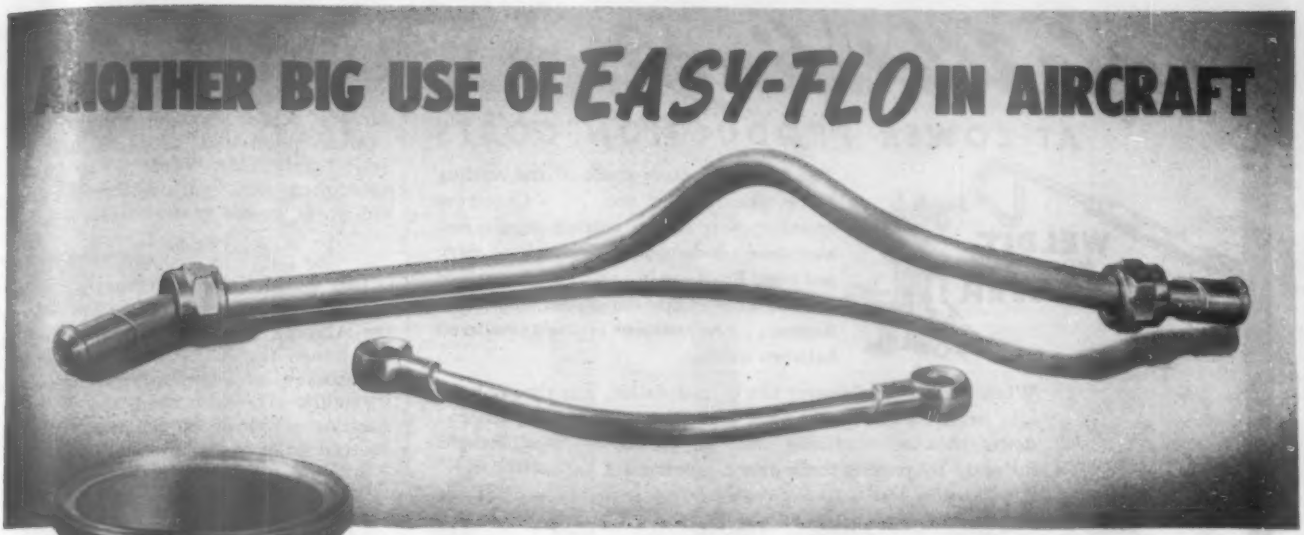
» «

Harold W. Saunders, manager of the San Francisco district of Air Reduction Sales Co. for almost 25 years, has been made an honorary life member of the San Francisco section of the American Welding Society, of which he has served as treasurer for more than 20 years.

» «

Recent additions to the personnel of Mir-O-Col Alloy Co., Los Angeles, include **E. L. Tetrick**, management consultant; **J. R. Pendleton**, sales manager; **M. M. Griffith**, welding research engineer; **Harry Brooks**, assistant sales manager; **R. E. Turman**, advertising manager.

ANOTHER BIG USE OF *EASY-FLO* IN AIRCRAFT



BRAZING FITTINGS TO PIPE AND TUBING

In most aircraft plants you'll find that on gas, oil, hydraulic and other lines they now use Easy-Flo to braze pipe and tube fittings permanently in place. Parts for connecting a fuel pump to a carburetor, shown above, and the engine coupling at the left are typical examples.

There are important reasons why Easy-Flo is so widely used for this work. This low-temperature silver brazing alloy consistently makes joints that equal the parent metals in strength in ability to stand severe vibration, shock and extremes of temperature, in liquid and gas-tightness, and they have high resistance to most types of corrosion. In short, an Easy-Flo brazed part is the **equivalent of a single piece in all essential properties.** What's more, the Easy-Flo method means **fast production at low cost.**

A FEW OF THE MANY AIRCRAFT PARTS BRAZED WITH EASY-FLO

- Spark Plugs
- Ignition Shields
- Carburetor Parts
- Carburetor Scoop Strainers
- Gas Lines
- Oil Lines
- Hydraulic Lines
- Electrical Connections
- Electrical Contacts
- Breather Pipes
- De-icers
- Instruments
- Instrument Connections
- Clamp Screws
- Radiators
- Oxygen Tank Manifolds
- Oil Coolers
- Cable Shield Connections
- Propeller Parts
- Machine Gun Parts
- Parachute Ripcord Grips

GET EASY-FLO DETAILS IN BULLETIN 12-A

Easy-Flo brazing speed, reliability and economy will continue to be as important to aircraft production tomorrow as it is today. Design and production engineers can easily check up on its immediate and future possibilities by sending for Bulletin 12-A—it gives full details.

ARMY (E) NAVY

HANDY & HARMAN FOUNDED 1867 QUALITY SERVICE

HANDY & HARMAN

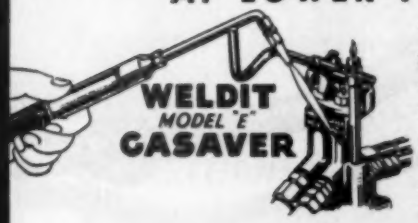
82 FULTON ST., NEW YORK 7, N. Y.

Bridgeport, Conn. • Chicago, Ill. • Los Angeles, Cal. • Providence, R. I. • Toronto, Canada

Agents in Principal Cities

Safe Welding

AT LOWER PRODUCTION COSTS



The Weldit Gasaver shuts off the welding flame when not in use. . . . Conserves essential materials by cutting oxygen and acetylene consumption as much as *fifty* per cent. Prevents injury to workmen—or sudden fires—from dangerous idle torch flames. . . . Adjustment remains unaltered between welds.

When the Weldit Gasaver has been installed, you simply hang idle torch on the handy lever rod. Weight of torch pulls rod down, thus automatically shutting off supply lines. Relight instantly by passing torch over Gasaver pilot light. No bother. . . . No time lost. . . . *No readjusting required.* . . . Price $10.00 at Detroit. Order today.

Better Soldering, Annealing and Heating Jobs

The Weldit Model CW Blowpipe is in daily use by many foremost industrial plants. . . . Built in accordance with the recommendations of leading fabricators of sheet metal products. . . . Operates on either natural gas, manufactured gas, or other low temperature fuel gas and compressed air. Stands up under rough shop use. . . . Send for literature.

WELDIT ACETYLENE CO.
628 BAGLEY AVENUE • DETROIT 26, MICH.

"SAF-T" CURTAINS for Welding Plants

Made of fine quality, heavy flame-proof duck.
Any size required.
Equipped with grommets ready to hang.
Color: Olive Drab.
SOLD THROUGH YOUR LOCAL JOBBER

Write for prices and descriptive material.

FRED JESSAR
404 Denckla Bldg. Philadelphia 7, Pa.

IMPORTANT POINTS OF SUPERIORITY

1. Fear of overheating can be forgotten.
2. Cleaning and grinding are unnecessary with "York's 77".
3. Chipping is unnecessary with "York's 77". A satisfactory bond is always guaranteed.
4. Deteriorated cast iron can be welded with "York's 77".

YORK ENGINEERING COMPANY
3349 OGDEN AVENUE • CHICAGO, ILLINOIS

Howard D. Flicker has been appointed production manager of the Long Island City plant of Salkover Metal Processing. This firm operates commercial electric furnace copper brazing and bright annealing plants in Chicago and Long Island City. Mr. Flicker was formerly associated with various metal-working industries in the eastern area.

» «

Leo F. McCaffrey, formerly assistant works manager in charge of operation of the Algoma Steel Co., Ontario, Canada, has joined the Allis-Chalmers Mfg. Co., Milwaukee, as an industrial engineering specialist. He will head the metal industries activities of the company's industrial sales department.

» «

Boyd E. Cass has joined the staff of the Foote Mineral Co., Philadelphia, in the capacity of welding engineer. He was formerly with Carnegie-Illinois Steel Corp., Youngstown, O., and later senior metallurgist at Baldwin Locomotive Works, Eddystone, Pa.

» «

Elmer J. Steger, manager of the pneumatic tool and appliances division of the Cleveland Pneumatic Tool Co., has also been appointed manager of the company's rock drill division. **Charles E. Vanderpool,** former assistant manager of the pneumatic tool division, has been made sales manager of that division. **Albert H. Hruby,** recently in charge of contract termination, becomes sales manager of the rock drill division. **Robert Craig,** former district manager at Salt Lake City, has been named manager of export sales.

Died . . .

Claude J. Holslag, president of Electric Arc Inc., Newark, died on June 11, following an operation made two weeks previously. He was 60 years old. He was one of the founders of Electric Arc in 1918, a director in 1920 and president in 1929. He was also a member of the American Welding Society, the American Institute of Electrical Engineers and the National Electrical Manufacturers Association.

Mr. Holslag was awarded the Samuel Wylie Miller medal of the American Welding Society in 1939 for "contributions in the development of a-c welding and coated electrodes." He held a number of patents for electric welding methods and related devices.

» «

David Owen Evans, a vice-president of The International Nickel Co. of Canada, Ltd., and chairman of The Mond Nickel Co., Ltd., its British affiliate, died suddenly in London on June 11 of a heart ailment at the age of 69. He had been Member of Parliament for Cardiganshire, North Wales, since 1932, and immediately prior to his death King George had approved the conferment upon him of the Honor of Knighthood.

ru'tile, 1. rū'til, 2. ru'til, n. Mineral. An adamantive, reddish-brown, transparent to opaque tetragoval titanium dioxid (TiO_2), usually containing a small quantity of iron (F., shining, L. rutilus, red) ru'til.

SYNONYM:

Ruflux

TAMCO is . . . and has been for a number of years . . . the largest supplier of titanium compounds used in welding rod formulation, such as rutile, potassium and sodium titanate. Also, we furnish alloys such as 40% low carbon ferro titanium, nickel and manganese titanium for special coating formulation and compounds such as zircon, potassium zirconate, etc. Manufacturing operations covering these compounds are carefully controlled, and uniform products are assured at all times.

★ ★ ★

1. Ruflux 61—A 93% to 95% TiO_2 containing rutile milled to from 0.5% to 1½% on a 200 mesh screen. Major impurities are SiO_2, $ZrSiO_4$, Fe_2O_3 and FeO. Injurious impurities such as S. and P_2O_5 are kept to a minimum.

2. Ruflux 84—A 93% to 95% TiO_2 containing granular rutile of similar analysis to Ruflux 61. This coarser rutile is used to avoid coating dry cracking.

3. Ruflux P—A potassium titanate containing approximately 73% TiO_2 and 19% K_2O. This compound is used for arc stabilization purposes and contains no injurious impurities. Ruflux P is milled to approximately 4% on a 200 mesh screen.

4. Ruflux S—A sodium titanate containing approximately 80% TiO_2 and 15% Na_2O. Another arc stabilizer and formulated to reduce hycroscopic action to a minimum.

5. Ruflux Z—A zirconium silicate containing approximately 65% ZrO_2 and 34% SiO_2 combined as $ZrSiO_4$. The compound is milled to 0.10% on a 325 mesh screen and due to its high melting point (3850° F.) is used as a slag stiffener.

6. Ruflux P. Z.—A potassium zirconate containing 80% to 81% ZrO_2, 14% to 15% K_2O, 3% to 4% SiO_2 and smaller percentages of TiO_2, Fe_2O_3, CaO, etc.

7. Ruflux T—A zirconium oxide containing from 90% to 91% ZrO_2, 5.00% SiO_2, 0.80% Na_2O and lesser percentages of TiO_2, CaO, Al_2O_3, etc. Ruflux T is milled to 0.1% on a 325 mesh screen.

8. 40% Low Carbon Ferro Titanium—containing from 38% to 42% Ti., 3% to 5% Si., 6% to 9% Al., 1% to 2% Cr. The alloy is milled to minus 80 mesh.

9. Tam Nickel Titanium—contains from 25% to 28% Ti., 60% to 65% Ni., 6 to 8% Al., 2% to 4% Si., and 2% to 5% Fe. The alloy is milled to minus 80 mesh.

10. Tam Manganese Titanium—contains from 27% to 29% Ti., 35% to 40% Mn., 20% to 25% Fe., 7% to 9% Al and 2% to 4% Si. The alloy is milled to 80 mesh.

Tamco also manufactures alloys such as Ferro Carbon Titanium, Bortam and boron containing titanium alloys, and various other titanium and zirconium compounds.

We will be glad to produce any other titanium and zirconium compounds of interest to the welding rod industry as soon as the emergency is over.

It pays to include these compounds in your welding rod coating formulation research.

THE MERIT MARK OF METAL
TAM
METALLURGICAL ALLOYS

A reasonable series of tests in your own plant will indicate the superiority of RUFLUX.

THE TITANIUM ALLOY MANUFACTURING COMPANY

Executive Offices: 111 Broadway, New York, N. Y. *General Offices and Works:* Niagara Falls, N. Y.

ANOTHER
"MAKE GOOD" STORY
OF COAST METALS
HARD-FACING

Hard-Faced
Mandrel
Outlasts Tool Steel Unit
15 to 1

Top service for tool steel mandrels in one plant was 10,000 bends. At that count they wore out and backed up—from bending stainless steel pipes.

However, after these mandrels were hard-faced with Coast Metals, service life jumped to 150,000 bends. Now there is no more back up, and only medium carbon steel is needed for the base metal of the mandrel, making possible a more economical construction.

You can build greater wear-resistance into any ferrous metal surface... repeatedly on worn or new parts... for a huge variety of machines . . . with Coast Metals Hard-Facing. It's inexpensive and easy to apply. Write for detailed new pamphlet: "Your Best Protection Against Wear".

COAST METALS, INC.
Plant and General Offices:
1232 Camden Ave., S.W. Canton 6, Ohio
Executive Offices:
2 West 45th Street, New York 19, N. Y.

COAST
METALS
hard-facing weld rods
MAKE YOUR
EQUIPMENT
LAST LONGER

Helpful Literature Just Published

The following reviews are of recent publications of interest to those in the welding industry. Unless otherwise stated, they may be obtained without cost by writing to the manufacturers listed.

Electrode Digest

A 36-page, 3½ by 8½ in. digest of pertinent facts about the Page line of electrodes and gas welding rods is just off the press. Written from "the buyers' standpoint," each of its pages contains information to make it easier to select the proper electrode or welding rod.

The booklet starts with an unusual type of index, which is based on the nature of the material to be welded. Electrode classification and page number are then given. After the index and other preliminary material, each electrode and welding rod is given full-page tabular treatment, the data being arranged with regard to ease of reading and use. Included for each electrode are such facts as: physical properties, analyses of the weld metal deposits, positions, polarity, recommended current ranges, finishes, sizes, lengths, color markings, packings and recommended applications. A copy of this digest, DH-821, can be obtained by writing to **Page Steel & Wire Div.,** American Chain & Cable Co., Inc., Monessen, Pa.

» «

War Contractors' Guide

The "Army-Navy Contractors' Guide for Prime and Subcontractors" is a 60-page, 8 by 10¼ in. manual issued jointly by the War and Navy Departments to suggest methods of advance planning and illustrate practical procedures for the settlement of terminated war contracts. It also tells how to use standard proposal forms and where to consult Army and Navy field officers. This pamphlet supersedes War Department pamphlet No. 34-2, Contractors Guide, 1 June 1944. A copy may be obtained upon written request to the **Readjustment Distribution Center,** 6th Floor, 90 Church St., New York City 7, attention: Lt. E. P. Lull.

» «

X-Ray Diffraction Booklet

A non-technical account of the methods used to analyze materials by means of their X-ray diffraction patterns is given in "X-Ray Diffraction Apparatus and Applications," a new 30-page, letterhead-size booklet.

This analysis is based upon the principle that a fine beam of X-rays passing through or reflected by a crystal (metal structure) will record on a photographic film a diffraction pattern characteristic of the internal arrangement of the crystal's atoms and molecules. Some of the applications explained in the booklet, Picker Bulletin 1245, are: to identify an unknown crystalline substance, to estimate the amount of a given substance present in a mixture, to identify substances having the same chemical formula but different structures, to predetermine the properties of a specimen and its adaptability to specified applications, to study the effects of various treatments on metals, to measure residual stresses, to determine equilibrium diagrams of alloys. **Picker X-Ray Corp.,** 300 Fourth Ave., New York City 10.

» «

Branch Pipe Outlets

The "WeldOlet" method of installing 90 deg branch pipe outlets is illustrated and explained in the 36-page, 5 by 6¾ in. "Handbook of Branch Pipe Outlets." The special "WeldOlet" fitting is saddled on and welded to the run pipe. The fundamental steps in the operation are: (1) align fitting and scribe run pipe; (2) flame-cut hole; (3) tack weld fitting to run pipe; (4) weld it in place; (5) weld or screw the other end of the fitting to the branch pipe.

The above method is suitable for making branch connections at all services and pressures in which seamless steel pipe of a standard weight is used. The various types of fittings available are: welding outlet, threaded outlet, socket outlet, size-to-size outlet, reducing-size outlet. Other pertinent information is given in the "WeldOlet" handbook. Dept. 265, **Bonney Forge & Tool Works,** Allentown, Pa.

» «

Airco Electrode Catalog

Airco's newly published 56-page catalog of welding electrodes is an elaborate and complete presentation. It is printed in two colors throughout and begins with a full-color page showing the color markings of the electrodes listed. Another feature is a combined electrode selector chart and index.

Complete descriptions and details of applications, welding procedures, mechanical properties, chemical analyses and specifications are given for the entire line of electrodes for welding mild steel, alloy steels, stainless steels, galvanized sheet steel, aluminum and other non-ferrous metals, hard-facing, etc. A reference section at the back offers information on plate edge preparation, estimating electrode requirements, welding symbols, a hardness conversion table and a glossary of welding terms. **Air Reduction,** 60 East 42nd St., New York City 17.

...May add MONTHS of use

Scraper blades for pug mills, road machinery or silica grinders like the one above can be treated with a strip of MIR-O-COL No. 2 (Production) hard-facing metal in from 30 minutes to an hour of weldor's time. This time, plus the low cost of the alloys, can be offset by the logged gain in operation efficiency and production life. Gears, sprockets, all types of bucket teeth, diagonal rolls, charging rams, cams, dies and many other points where metal meets wear, are being surfaced today with MIR-O-COL metals. Learn how this fast-flowing metal can earn more operating profits for you. Write today for your distributor's name.

ASK FOR THIS BOOK

Send your name and address to MIR-O-COL Alloy Company for your FREE copy of "Weldor's Guide to Successful Hard-Facing." Also indicate if you wish to receive a monthly copy of MIR-O-COL News.

MIR-O-COL
HARD-FACING RODS
ALLOY COMPANY
2416-60 EAST 53RD STREET, LOS ANGELES 11, CALIFORNIA

POPULAR

Getting workers to wear safety equipment is a constant problem, especially on "semi-hazardous" jobs such as light grinding, woodworking and spot welding. The Willson Protecto-Shield meets this problem because it combines *new comfort* and *smart appearance* with day-long protection for both front and sides of face and forehead.

COMFORTABLE

Both men and women appreciate these comfort features. Light weight. Tilting visor "stays put" in any position. Plenty of room for spectacles. Clear plastic visor free from optical distortion.

PRACTICAL

Exclusive "Slot-Lock" holds visor securely in place. Can't be jarred loose. Easily replaceable. Three visor-lengths —4, 6 or 8 inch. Two thicknesses—.030 or .060 inch. Two colors—clear or green. Visor and sweatband easily replaceable.

For help on eye protection problems, consult your Willson Distributor or write for information to Dept. WE-10.

GOGGLES • RESPIRATORS • GAS MASKS • HELMETS

DOUBLE WILLSON

PRODUCTS INCORPORATED

READING PA U S A

Wage Incentive Plans

Significant increases in war production resulting from the use of wage incentive plans are reported in the War Production Board's recently issued "A Handbook on Wage Incentive Plans." Forewords by J. A. Krug, WPB chairman, and Joseph D. Keenan, vice-chairman of labor production, credit the use of wage incentive plans as a factor in increasing war production. The plans are said to permit substantial increases in wages while at the same time effecting decreases in the unit cost of production. "On the average, an increase in production per man-hour of about 40% occurred in the first 90 days of operation," the handbook states. "Wages increased an average of 15 to 20%, and costs decreased about 10 to 15%."

This publication was compiled under the direction of J. W. Nickerson, former director of the Management Consultant Division, and his successor James H. Eddy. A copy may be obtained for 10c from the **Superintendent of Documents,** Washington, D. C.

» «

Leaflet on Rust Prevention

A two-page, letterhead size leaflet describes "Spekleen No. 51," a prepared metal dip for use after pickling and finishing operations to inhibit the formation of rust. Steel pieces treated in the laboratory with this solution are said to have withstood over two months of exposure to the atmosphere without showing signs of rust. **Special Chemicals Co.,** 30 Irving Place, New York City 3.

» «

Alloy Electrode Catalog

Eureka's new eight-page, letterhead-size catalog covers seven alloy welding electrodes: a high-nickel, high-chromium, heat-resisting austenitic electrode; a copper-nickel electrode that produces machinable welds on cast iron; a copper-tin-phosphor bronze electrode; a general all-purpose copper electrode; an annealed soft steel electrode coated for the special purpose of welding cast iron; and two "Drawalloy" tool-steel electrodes. For each electrode is given the standard sizes, amperage range, identification, recommended applications and suggested welding procedure.

The new catalog is illustrated with many pictures of typical welding jobs and is attractively printed in red and black. **Welding Equipment and Supply Co.,** 223 Leib St., Detroit 7.

» «

Abrasives Handbook

Engineers, shop men and other users and buyers of coated abrasives should find many serviceable facts in the newly published, "Coated Abrasives," a 40-page, 5½ by 7½ in. handbook and digest of coated abrasive technology by E. B. Gallaher, M. E. The author, a leading consultant on the subject, gives authoritative information concerning the nature of materials used and methods of manufacture, grain gradings, technical vs. non-technical abrasives, fragile and tough grains, backings, adhesives, etc. A useful feature is a list of trade names with the corresponding real names of the abrasives used in their respective coatings. A copy of this handbook may be obtained without charge by writing to the publisher, **Clover Mfg. Co.,** Norwalk, Conn.

» «

Repairing Tractor Parts

"How to Repair Tractor Parts by Arc Welding" is the title of eight-page, letterhead-size Bulletin GEA-3329, available from **General Electric Co.,** Schenectady 5. This pamphlet discusses the techniques used in the rebuilding and resurfacing of the worn parts of a large crawler-type Diesel tractor, including the driving sprockets, bottom rollers, front idlers, track rails, top rollers, track grousers and drawbar clevis.

» «

Metal-Cleaning Bulletin

An eight-page, letterhead-size folder covers "Klem Kleaners" and other products for rust removal, metal cleaning and degreasing, pickling and soldering. Fully described procedures are given to acquaint the shop superintendent or factory manager with the use of phosphoric acid cleaners, alkali power washes, emulsion and electrolytic cleaners, etc. **Klem Chemical Works,** 1500-18 E. Woodbridge, Detroit 7.

» «

Projection-Welding Manual

Projection welding, its part in the field of resistance welding and its applications in connection with headed and threaded products is the broad subject treated in a 16-page, 6 by 9 in. manual, "Projection Welding" (revised edition).

The manual begins by defining projection welding as "a method of resistance welding by which the current flow and heating during welding are localized at a predetermined point by the design of the parts being welded. This is usually accomplished by a projection or embossment on one or both of the pieces of work." Methods of effecting such projections are then discussed. Other sections of the manual cover press welders, controls, weldable materials, jigs and fixtures. **Ohio Nut & Bolt Co.,** Berea, O.

» «

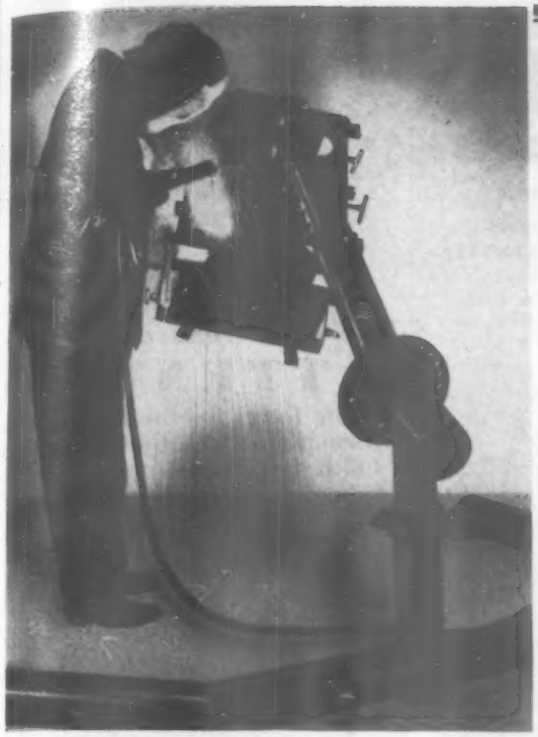
Lift-Truck Leaflet

Lift trucks, hydraulic elevating tables and other Lyon-Raymond products are briefly described and pictured in a two-page, letterhead-size leaflet, Bulletin 139. **Lyon-Raymond Corp.,** 2245 Madison St., Greene, N. Y.

» «

Diamond Grinding Wheels

A 15 by 14 in. folder on vitrified bonded diamond grinding wheels has been published by **Norton Co.,** Worcester 6, Mass. These wheels are employed principally for sharpening carbide tools.



BALANCED Positioning

Saves 40 Minutes per Piece!

Bentley *Balanced* Positioners can save you production time through *hand* rotation (360°) and tilting (135°). Underside of work is made as accessible as any other part by mounting holding fixture on small flange of rotation spindle, instead of on face plate. Down welding at all times. Suitable also for assembly operations, spray painting, shot blasting and many other types of work.

No power equipment needed for operation. Pedestal has vertical adjustment. May be set in floor or in wall bracket. Tilting spindle is *below* face plate to permit work on long structures. Capacity 500 lbs. with center of gravity from 6" to 12" above face plate. 150 lb. capacity also available. Timken bearings and all-welded construction. Work table 30" in diameter. Notice ample foot room allowed by movable base.

Investigate Bentley BALANCED Positioners for faster postwar production. Our engineers will be glad to review your problem.

BENTLEY WELDERY, Inc. Box 1038, Dept. 1, Syracuse, N. Y.

EASY-FLO RINGS

"WED" METALS TOGETHER FOR KEEPS

It's the fashion today to join metals with **preplaced rings of EASY-FLO** silver brazing alloy wire—first, because low-temperature EASY-FLO means fast, reliable, low-cost brazing—second, because preplacing the alloy speeds production, gives accurate control of amount of alloy and assures uniform distribution throughout a joint—and finally, because metals joined by EASY-FLO will never be parted by vibration, shock or extremes of temperature. They're **one for keeps.** START NOW to get the benefit of EASY-FLO's speed, reliability and economy in your metal joining operations present and future. **BULLETIN 12-A** tells you how. Write for your copy today.

EASY-FLO fabricated Air Speed Indicator Part. 6 joints in upper assembly brazed simultaneously—then 10 in lower. EASY-FLO rings preplaced at all joints.

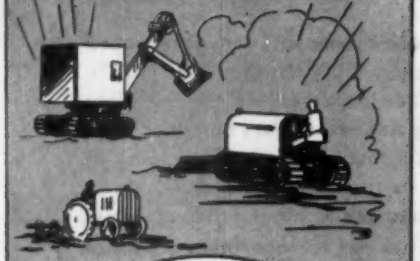
STEEL SALES CORPORATION

WAREHOUSES

Chicago, Ill. 3348 S. Pulaski Rd., Phone Crawford 4400
Detroit, Mich. 5151 Wesson Ave., Phone Tyler 6-3000
St. Louis, Mo., 4565 McRee Ave., Phone Grand 5255

DISTRICT OFFICES

HARD FACING?



THESE
AGILE
ELECTRODES
WILL SOLVE 90% OF YOUR PROBLEMS

DARK GREEN: For economical repair of wearing parts on machinery, plows, excavator buckets, shovel teeth, valves and dies, as well as any other machine part damaged by severe wear and impact.
Brinell Hardness 400-600.

PINK: For hard-surfacing of steel parts in process manufacturing as well as for refacing of worn carbon steel parts, mainly worn or battered rail-ends, tractor shoes and car-wheels.
Brinell Hardness 290-400.

RED: A medium hard and abrasion resistant hard-surfacing material where machineability after welding is required. Usual applications are the rebuilding of gears, knuckles, brakeshoes, clutches, etc.
Brinell Hardness 200-250.

VIOLET: A self-hardening, 12-14% manganese steel weld deposit for the building up of surfaces exposed to extreme impact and abrasion, such as railway frogs, crusher jaws and rolls, pulverizer hammers, etc.
Brinell Hardness 200-490.

AMERICAN AGILE CORPORATION
5806 HOUGH AVE.
CLEVELAND 3, OHIO

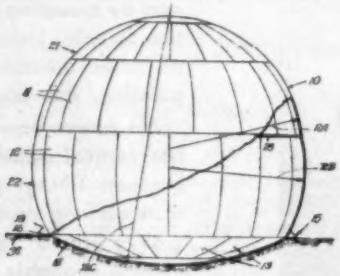
AGILE ACTARC

SEND FOR FREE CATALOG

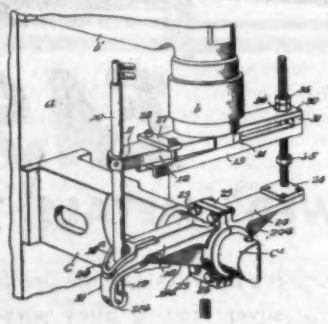
FROM THE PATENT OFFICE

Welded Pressure Tank

2,376,263. **Charles L. Marner,** East Chicago, Ind., assigned to **Graver Tank & Mfg. Co., Inc.,** East Chicago. Filed March 19, 1943. Issued May 15, 1945.



A closed container substantially in the shape of a solid of revolution and including an approximately spherical portion and a dished bottom. The spherical portion has a top semispherical section and a lower section conforming to a median segment of a sphere having a center which does not coincide with the center of the top. The junction of these sections lies in a horizontal plane as does the junction with the dished bottom. A girder is placed at the junction of the spherical sections, and a second girder is located at the junction of the tank with its dished bottom. The junction of the spherical sections forms an exterior angle of less than 180 deg, interrupting the spherical contour of the tank above the dished bottom.



Spot Welder

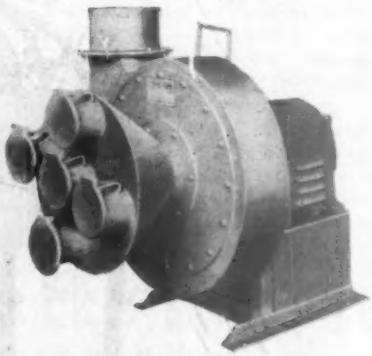
2,375,439. **Nate Rekosh,** Miami Springs, Fla., assigned to **Consolidated Vultee Aircraft Corp.,** San Diego, Calif. Filed Feb. 14, 1944. Issued May 8, 1945.

A spot welder with a slidable structure including a ram, an upper arm carrying an electrode, and an extension member extending outwardly in opposite directions from the ram. A lower electrode-arm and an extension member are stationarily mounted on a support below the ram. The extensions are provided with rigid abutments for transmitting positive, counter or balancing pressure from the ram to the lower arm during welding periods.

The General Says
ATTENTION
Write today for the complete information which General Blower Co. has prepared for you regarding

GENERAL WELDING FUME EXHAUSTERS

Ask for Portfolio CB-103—W.E.

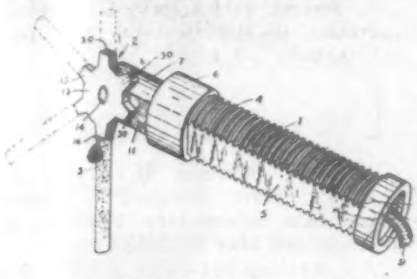


High Velocity Exhaustion by High Speed Centrifugal Fans 2 to 10 Inlets

GENERAL BLOWER COMPANY
Producers Of Air Moving Equipment
401 North Peoria Street
Chicago 22, Illinois

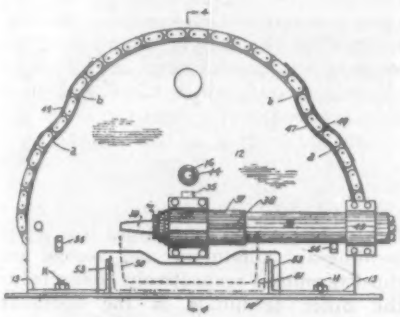
Electrode Holder

2,376,943. **William E. Smith,** Detroit, assigned to **The Midland Steel Products Co.,** Cleveland. Filed Dec. 3, 1942. Issued May 29, 1945.



An electrode holder having a conductor disc mounted upon a transverse axis and projecting beyond the end and sides of the holder. The disc is of such thickness that an electrode can be secured to its broad curved peripheral face at any point about an axis extending transversely of the holder.

» «

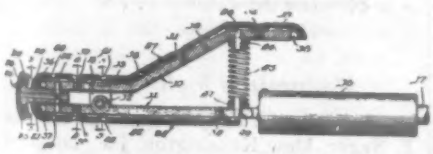


Shape-Cutting Machine

2,378,017. **Charles G. Hubkey,** Denver, Colo. Filed March 20, 1944. Issued June 12, 1945.

An oxy-acetylene shape cutter for cutting beams and the like. It comprises a base, a frame secured thereto, a torch guide pivoted to the frame, a torch slidably connected with the guide, a track on the frame having different portions spaced different distances from the pivot, a chain movably associated with the track, means for constraining the chain to follow the track, means for interconnecting the outer end of the torch with the chain, and means for moving the chain along the track so that the torch will turn about the pivot and slide relative to the guide in response to the track contour.

» «



Electrode Holder

2,377,047. **Eric Siemers,** Kalamazoo, Mich., assigned to **Roscoe B. Lacey,** Kalamazoo. Filed Nov. 8, 1943. Issued May 29, 1945.

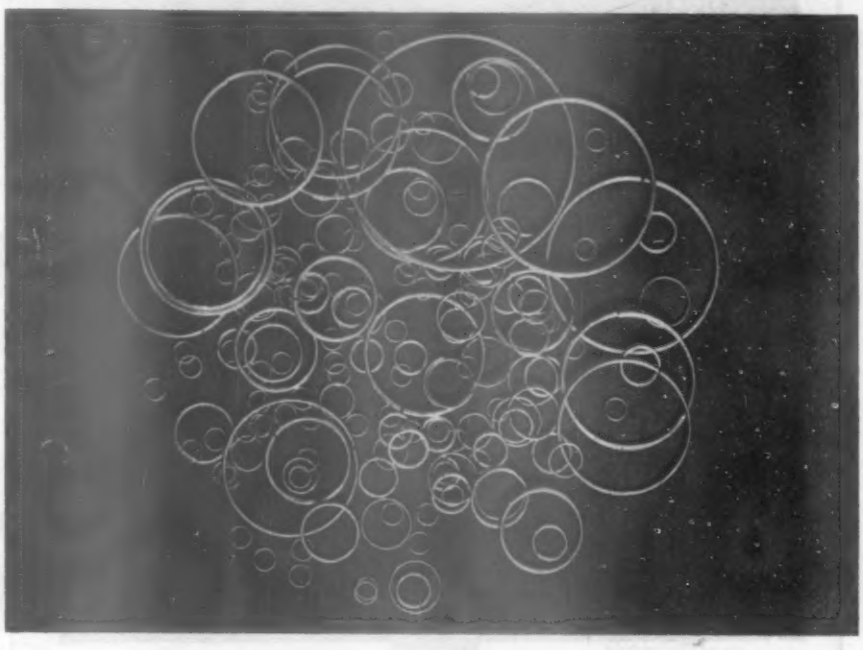
An electrode holder having metal jaws pivotally connected intermediate their length, channeled covers of insulating material and an insulating handle secured to one end of one jaw. A coil spring is located between the jaws at the end adjacent the handle. The insulating covers are releasably secured to the outer surfaces of the jaws to insulate these metal parts. Each cover has a substantially arcuate shape in transverse section to provide a ventilating space between the cover and its jaw. Shoulders are provided on the inside surface of each cover for properly seating the cover on its respective jaw. An opening in the curved central portion of each cover communicates with the ventilating space in order to facilitate the escape of heat from the jaws.

» «

Spot-Welding Circuit

2,377,328. **John W. Dawson,** West Newton, Mass., assigned to **Raytheon Manufacturing Co.,** Newton. Filed Feb. 2, 1943. Issued June 5, 1945.

A spot-welding circuit including an energy-storage means for supplying a controlled initial wave front of welding current to a welding load. A source of current is connected to the load at substantially the peak of the initial wave front in order to maintain a substantially constant direct current through the load.



WE MANUFACTURE
SILVER BRAZING ALLOY RINGS

Use of our low temperature Easy-Flo Brazing Alloy Rings means fast, reliable low cost brazing. Pre-placed rings speed production, give accurate control of alloy used, assures uniform distribution throughout the joint. We manufacture rings in practically all sizes, also from other types of wire, likewise springs. Easy-Flo also available in standard wire form. Our facilities are complete for assured speedy delivery, and special packaging is available. Discussion of your requirements is invited.

CHARLES W. KRIEG COMPANY

52-60 Dickerson St. • HUmboldt 2-3445 • Newark 4, New Jersey

A-C Welder Circuit

2,374,930. **Kenneth N. Gray,** Akron, O., assigned one-half to **Edward Bogard,** Akron. Filed Jan. 9, 1943. Issued May 1, 1945.

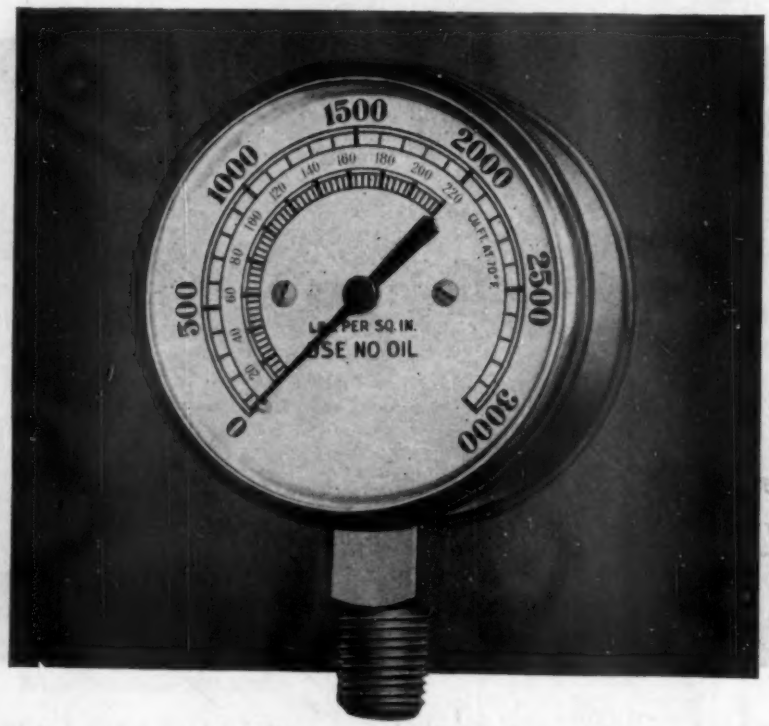
Welding apparatus including an a-c circuit, a work holder, a welding electrode and a transformer with primary and secondary windings. Primary winding is connected to the a-c circuit, while the several secondary windings are connected to the work holder at one of their ends. Spaced contacts arranged in stepped relation separately connect with the other ends of the secondary windings. A switch lever electrically connected with the electrode coöperates with these contacts to connect and disconnect the secondary windings.

» «

D-C Welder

2,373,598. **Alfred Reeb,** Philadelphia, assigned to **Edward G. Budd Mfg. Co.,** Philadelphia. Filed May 27, 1943. Issued April 10, 1945.

In d-c arc welding, a generator, a conductor for conducting current to the welding electrode, a conduit for conducting air to the welding arc from the generator, and a fan for cooling the generator and forcing air through the conduit to the welding arc in order to dissipate the welding fumes.



AUTO-LITE Pressure Gauges

OPERATORS who cut, treat or join metals by oxy-acetylene flame processes have the assurance and protection of proper pressures when their equipment includes Auto-Lite Pressure Gauges.

These gauges save man hours, serve to hasten essential production and conserve vital gases through precise pressure indication. Designed and manufactured by pioneers in the development of dial-type precision instruments, Auto-Lite Pressure Gauges are standard equipment for oxy-acetylene apparatus, and are listed as approved by Underwriters Laboratories.

THE ELECTRIC AUTO-LITE COMPANY
INSTRUMENT AND GAUGE DIVISION
CHRYSLER BUILDING, NEW YORK 17, N. Y.

FACTORY LA CROSSE, WISCONSIN

Gold-Base Brazing Solder

2,374,995. **Franz R. Hensel,** Indianapolis, assigned to **P. R. Mallory & Co., Inc.,** Indianapolis. Filed Aug. 4, 1942. Issued May 1, 1945.

A brazing solder formed of 20-40% cadmium, 10-20% zinc and the balance substantially all gold.

» «

A-C Welder Control

2,376,215. **Alanson U. Welch, Jr.,** Pittsfield, Mass., assigned to **General Electric Co.,** Schenectady. Filed Aug. 28, 1943. Issued May 15, 1945.

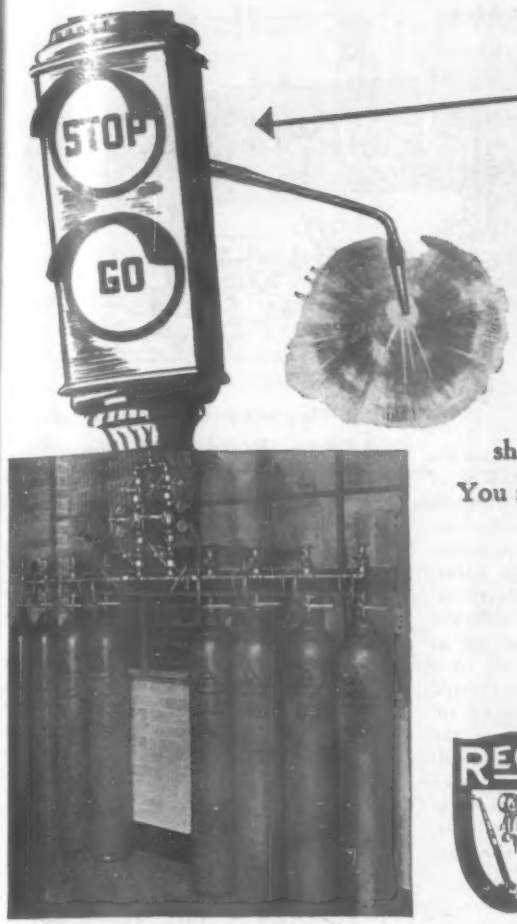
A-c welding apparatus comprising a supply circuit, a welding circuit having an inductive device connected in circuit with a pair of conductors for energizing a welding arc, a resistor, and first and second relays. One terminal of the operating windings of the first relay is connected to one of the welding-arc conductors, and one terminal of the operating winding of the second relay is connected through the normally open contacts of the first relay. Second relay has normally open contacts, which complete the connection of the supply circuit with the welding-arc conductors, and normally closed contacts, which compete a shunt circuit through the resistor about the operating winding of the second relay and the normally open contacts of the first relay. A voltage-establishing means energized from the supply circuit has a first terminal connected to the other welding-arc conductor and second and third terminals respectively connected to the other terminals of the operating windings of the second and first relays. The voltage between the first and second terminals of the voltage-establishing means is of sufficient magnitude to cause the second relay to close its contacts when the welding-arc conductors are short circuited before the welding circuit is connected to the supply circuit. When this voltage is vectorially combined with the operating voltage across the conductors, the resultant voltage produced causes the second relay to maintain its contacts closed. The connected voltage of the voltage-establishing means is of sufficient magnitude to cause the first relay to close its contacts, and the voltage between the first and third terminals is of sufficient magnitude when vectorially combined with the operating voltage across the welding arc to produce a resultant voltage which causes the first relay to maintain its contacts closed so long as the operating voltage is less than a predetermined value.

» «

Magnesium Welding Rod

2,375,601. **Ludwig J. Weber** and **George F. Sager,** New Kensington, Pa., assigned to **Aluminum Co. of America,** Pittsburgh. Filed Oct. 4, 1943. Issued May 8, 1945.

A welding rod composed of a zinc-free magnesium base alloy containing from 0.5-3% aluminum, and 0.2-0.8% manganese. The balance is substantially all magnesium.



Are YOUR WELDING OPERATIONS LIKE A TRAFFIC LIGHT?

● You can eliminate costly "Stop-Go, Stop-Go" operations in your shop by installing the RegO Manifold designed for your requirements.

You not only gain the advantage of uninterrupted operations, but also save valuable production space and eliminate hazards, time and trouble caused by wheeling full and empty clinders through a busy department.

Learn about *all* the advantages you can get with RegO Manifolds . . . there's no obligation . . . write today!

REGO — ARMY E NAVY

The BASTIAN-BLESSING Company

4239 Peterson Ave. • Chicago 30, Ill.

Pioneers and Leaders in Equipment for Using and Controlling High Pressure Gases

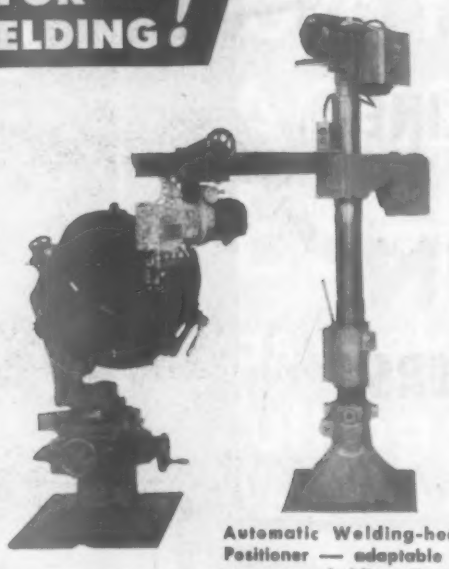
See THIS FIXTURE FOR AUTOMATIC WELDING!

A BIG TIME SAVER!

THIS Acme dual fixture arrangement permits practically constant use of an automatic welding head, because one of the fixtures can be reloaded while the other is engaged in the welding operation.

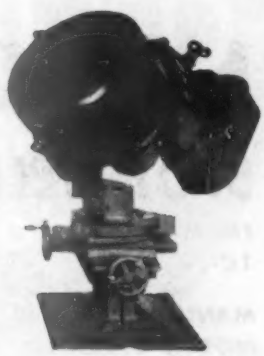
The holding machine can be set to revolve at any angle from vertical to horizontal. (Illustration shows a wheel being welded at 45° angle.) Positioner arm swings from one fixture to the other, locking in proper position. Speed of rotating the work is adjustable, as desired.

WRITE
for information relating to your particular welding fixture problem



Automatic Welding-head Positioner — adaptable to your own holding fixture.

Reloading Is Done During Welding Operation

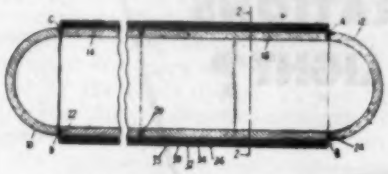


ACME *Manufacturing Co.*
1642 HOWARD ST. • DETROIT, MICH.

Laminated Pressure Vessel

2,376,351. **Cecil H. Gay,** Akron, O., assigned to **The Babcock & Wilcox Co.,** Newark. Filed May 17, 1941. Issued May 22, 1945.

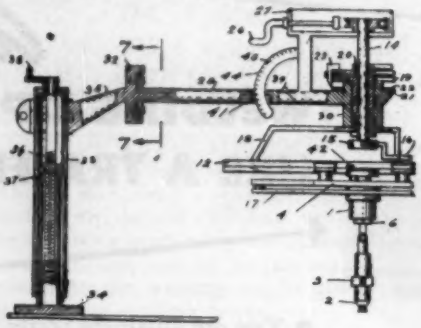
A pressure vessel having an inner shell of single plate thickness made from a



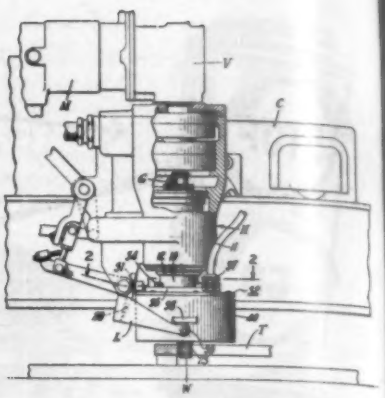
number of integrally united plate sections. Dished heads of the same plate thickness and same diameter as the shell are united to it by circumferential welds. The combined inner shell and heads are then heat treated to free them of local stresses caused by welding. There is also an outer shell consisting of concentric annular laminations of sheet metal or thin plate superposed around the inner shell. Each of the superposed bands is completed by a weld. The thickness of each lamination is a small fraction of the wall thickness of the inner shell. Each band is clamped in position on the shell and tack welded; the edges are then permanently welded along a single seam. The outer shell laminae are so positioned and of such number and strength that their stresses due to internal working pressure are of a magnitude below the requirements of stress relieving and X-raying.

Cutting and Beveling Machine

2,377,844. **John T. Stone,** Baltimore. Filed May 7, 1943.



In a device for moving a torch along a predetermined path, the combination of a supporting frame and rotatably mounted holder having angular indicating means to show the position of the torch. The holder supports at one end a rotatable frame, in which a carriage is reciprocably mounted and rotatable with the frame. A link is pivotally connected at opposite ends to the carriage and to a centrally located and rotatably mounted spindle. A stop adjustably mounted on the spindle limits the movement of the carriage on the rotatable frame. An adjustable bumper on the holder engages the stop in order to rotate the frame in predetermined relation to the spindle. The torch holder is carried by the carriage and operates therewith.



Magnetic Tracing Head

2,378,021. **Roscoe R. Lobosco,** Elizabeth, N. J., assigned to **Union Carbide and Carbon Corp.,** New York City. Filed April 1, 1943. Issued June 12, 1945.

A magnetic tracing head comprising a housing, a shaft, a template-follower roller on the shaft, a motor to drive the shaft, a solenoid coil mounted in magnetic circuit with the shaft for magnetizing the roller, means for rectifying current to energize the solenoid coil, and means in electrical circuit with the coil to reduce the pulsations in the force of attraction between the template and the roller produced by energization of the coil.

» «

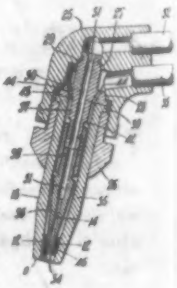
Spatter Preventative

2,377,048. **George W. Smith,** Dayton, O. Filed July 27, 1942. Issued May 29, 1945.

A composition to be introduced in a seam to be welded. Major solid constituents are magnesium silicate, hydrated lime and a relatively small quantity of graphite, all finely comminuted and suspended in water to form a fluid.

» «

Torch Tip



2,376,413. **Roger S. Babcock,** Plainfield, N. J., assigned to **Union Carbide and Carbon Corp.,** New York City. Filed Feb. 26, 1941. Issued May 22, 1945.

A torch tip having a central cutting-oxygen orifice and a plurality of oxy-acetylene preheating gas ports arranged in a circle concentric with the orifice. Each of the oxy-acetylene flames has an inner cone and an outer heating envelope; the outer envelopes are merged and concentrated symmetrically about the cutting stream into a single annular flame. This is done by means of an annular skirt adapted to surround the flames in concentric relation with the oxygen stream. The skirt has an inner diameter equal to the sum of the diameter of the flame circle and the width of three ports, and the flame circle has a diameter equal to 1½ times the diameter of the cutting orifice.

SEND FOR DETAILS

ON THE

COMPLETE LINE

OF

LARKIN

SPOT WELDERS

FROM

10-50 KVA

MANUAL, AIR AND MOTOR OPERATED MACHINES.

LARKIN A.C. ARC WELDERS FOR EVERY NEED

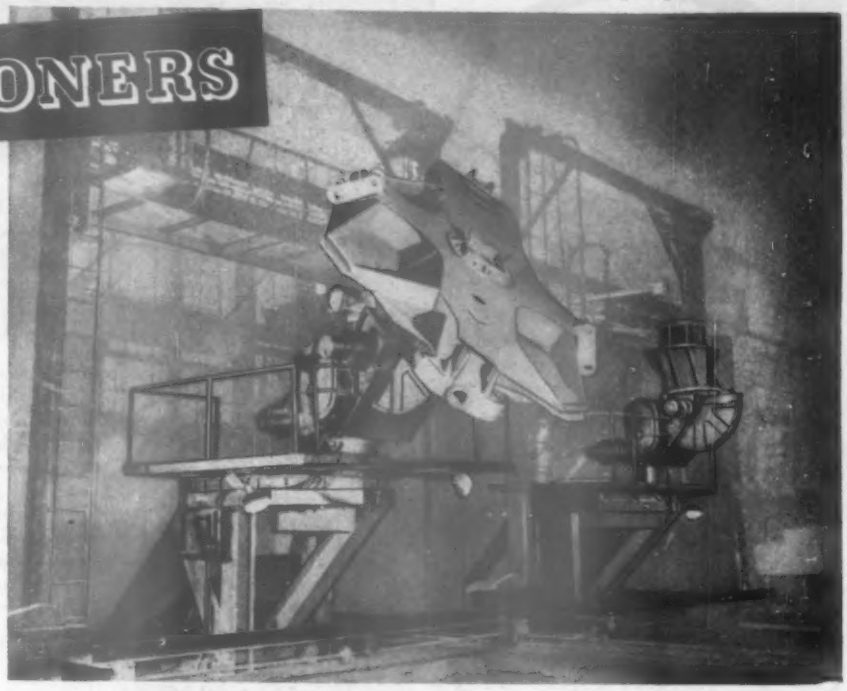
● LARKIN MODEL # R 12

LARKIN LECTRO PRODUCTS CO., MANUFACTURERS

220 Taaffe Place, BROOKLYN 5, N. Y. ● Sales offices throughout the country

Production Set-up like this forecasts a new "shop practice"

C-F POSITIONERS



By welding on C-F Positioners, some manufacturers far out-produced all estimates of "possible" "War Production." Not only did this method increase out-put, it saved material and increased strength and quality while lowering the cost per unit. Under post-war competition automatic welding on C-F Positioners is certain to become standard manufacturing practice for many products. It is a new method that permits downhand welding of all sides and angles from a single set-up. A method you should know and understand.

Write for Bulletin WP-22

CULLEN-FRIESTEDT CO.

1309 S. Kilbourn Ave. Chicago 23, Ill.

Type **BX** (Patented)

Comfortable to wear, it provides adequate protection, ample ventilation. Opaque side protectors. Multiple adjustment. Federal Specification Lens held securely in place in durable retainer. Manufacture in larger volume has resulted in 16⅔% price reduction. Contact your dealer or write us for folder.

Use this JACKSON EYESHIELD on gas welding and cutting jobs

- buy it at a new low price

NOW $3.75

JACKSON PRODUCTS

3265 Wight Street
Detroit 7, Michigan

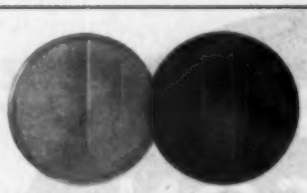
In Canada: C. H. Henze Co., Windsor; Hollup Corporation, Limited, Toronto; Leavitt Safety Appliances Co., Toronto; Paragon Supplies, Limited, Vancouver; Flecks Bros. Limited, Vancouver.

"Things will look up, when you start using

COLONIAL GLOVE AND GARMENT SPLITS

THEY INSURE THE MAXIMUM OF COMFORT... safety... and durability. All weights for men and women welders' gloves and garments, in large spread whole kips and side splits. Samples.

COLONIAL TANNING CO.
Glove and Garment Leather Division
MILWAUKEE, WIS.



W-AL-CO
COVER LENSES

for Gas Welding.
Spatter-resisting or plain.

GOGGLE LENSES (50 mm)

Protect Your Vision with the Best in Lenses and Plates

WELDING ALLOYS MFG. CO.
744 Broad St., Newark 2, N. J.

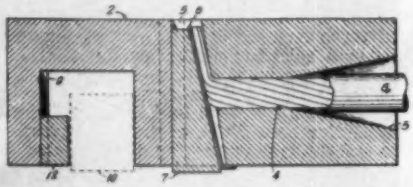
W-AL-CO

SUPER-PLATE FILTER LENSES for Helmets and Handshields.

Ground Cable Clamp

2,374,324. **Carl M. Blough,** Johnstown, Pa., assigned to **Carnegie-Illinois Steel Corp.** Filed March 13, 1943. Issued April 24, 1945.

A ground cable clamp for an arc welder comprising a block having four flat sides.

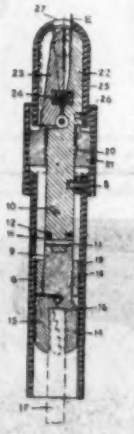


The cable is received in a frusto-conical opening in one end of the block, and this opening intersects with a tapered opening extending through the block from the side. A wear plate in the tapered opening is adapted to contact the cable, which is wedged between the wear plate and the tapered opening. A slot in one side of the block receives a workpiece, and a wedge in this slot fastens the clamp to the work.

» «

Electrode Holder

2,374,421. **Andrew D. Clyburn,** New Orleans, assigned 50% to **Dalton B. Shourds,** Gulfport, Miss., **Claude E. Hooton,** Houston, Tex., and **Eugene Mogabgab,** New Orleans. Filed Jan. 5, 1943. Issued April 24, 1945.



An electrode holder comprising a tube of insulating material holding a conducting member. A means for holding the end of a lead-in cable is located at the lower end of the conducting member. Integral with the upper end of the conducting member is a fixed jaw, to which is attached a movable jaw. Conducting member is screw threaded below the jaws. A threaded sleeve, covered with insulating material, engages the screw threads of the conducting member and is adapted to be turned to engage the movable jaw and move it toward the fixed jaw to grip the electrode.

» «

Cutting Torch

2,371,970. **Daniel A. Marra,** Cheswick, Pa. Filed Dec. 5, 1941. Issued March 20, 1945.

This patent pertains to a torch body having separate fuel-gas and oxygen passageways, a valve chest in each passageway, a valve structure in each chest, and a valve-operating device for each valve structure. The invention consists of a member having a passage arranged in the line of flow through the chest. The valve elements in the chest are arranged for cooperation, one at each end, with the ends of the passage. The valve-operating device consists of a stem extending through the previously mentioned member and serving to hold the valve elements spaced apart a greater distance than the length of the passage. A spring normally urges one of the valve elements towards flow-inhibiting position over one end of the passage. The valve stems of both valve structures may be shifted to shift the first valve element of both out of flow-inhibiting position. A bypass arranged with each valve structure affords a restricted flow of fuel gas and oxygen when the second valve elements enter the flow-inhibiting position.

12,000
CUSTOMERS
AMONG THEM ARE:— Bureau of Ships, Wash., D. C.; Henry J. Kaiser Co., Calif.; Pacific Bridge Co.; Bethlehem-Hingham Shipyards; Hercules Powder Co.; Stone & Webster; E. I. Du Pont de Nemours & Co.; Crane Co.
COLD PIPE, CONDUIT and TUBE BENDING MACHINES
American Pipe Bending Machine Co., Inc.
13 Pearl St., Boston, Mass.

Anti-Spatter

"FOR BETTER WELDING"

ANTI-SPATTER practically eliminates oxidation—cuts down the amount of slag covering weld. It also fortifies the action of rod coating—less slag, easier to remove. Weld rust practically eliminated.

Easy to apply—simply brush on before welding. After welding, **ANTI-SPATTER** is easy to remove. If surface is to be painted, remove with wet cloth or usual degreasing methods—otherwise use dry rag.

Get speedier and better looking production and save man hours in costly cleaning. **ANTI-SPATTER** is non-inflammable, non-toxic and has no disagreeable odors.

WRITE TODAY FOR DESCRIPTIVE FOLDER ON ANTI-SPATTER

TRI-FLUX
A new and hotter soldering flux.
No. 5 for Stainless and Monel Metal.
No. 3 for All other metals.
Write for details.

Distributors write us.

FLAME-PRUF
Ideal protection for welders' clothes.
Odorless, low cost, easy to use.
Write for details.

THE WOLFE-KOTE CO.

SHEBOYGAN • WISCONSIN

Let's suppose you could *make your own* GASOLINE, FOR 5¢ TO 10¢ PER GALLON!

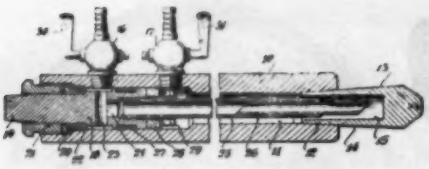
● If you could manufacture an unlimited supply of high-test gasoline for your own use, at about a nickel a gallon, you'd buy the equipment to do so mighty soon—particularly if that equipment proved to be reasonably priced and easy to operate.

We don't know where you can buy a machine of this type. However, you *CAN* buy a SIGHT FEED generator to make your own acetylene, and save 50% to 75% of the money which you are now paying for "bottled" acetylene.

Think it over, and then contact your jobber or drop us a line and request a SIGHT FEED catalogue. You'll be glad you did!

ACETYLENE *Sight Feed* GENERATORS

THE SIGHT FEED GENERATOR COMPANY
RICHMOND, INDIANA



R-W Electrode Holder

2,374,979. **Chester F. Carlson,** Jackson Heights, N. Y., and **Edman F. Holt** and **Robert F. Huddleston,** Indianapolis, assigned to **P. R. Mallory & Co., Inc.,** Indianapolis. Filed March 18, 1943. Issued May 1, 1945.

A resistance-welding electrode holder with a hollow body and a socket for receiving the electrode. Liquid inlet and outlet conduits communicate with the hollow interior of the body and are closed by valves. A piston is moved by hydraulic pressure in order to dislodge the electrode.

» «

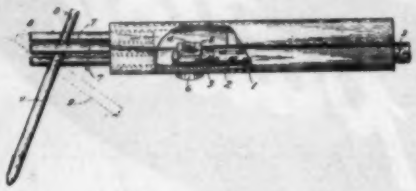
R-W Electrode Holder

2,374,284. **Preston M. Hall,** Worcester, Mass. Filed Feb. 29, 1944. Issued April 24, 1945.

A resistance-welding electrode and holder in which coacting surfaces of the electrode and holder engage to provide a liquid seal. Holder has a locking element, and the electrode is provided with sufficient lateral clearance with respect to the outer end of the holder to facilitate separation of the parts.

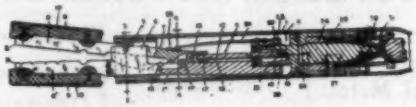
Electrode Holder

2,374,825. **Frank J. Malnar,** Euclid, O. Filed Oct. 1, 1942. Issued May 1, 1945.



An electrode holder comprising several parallel metal rods supported at one end and spaced apart from each other throughout their full lengths. These rods are so arranged that an electrode may be held between two of them on one side and one rod in the other side by spring pressure. A means is provided for conducting electric current to at least one rod.

» «



Electrode Holder

2,375,836. **Phillip L. Bourque,** Detroit. Filed Jan. 17, 1944. Issued May 15, 1945.

An electrode holder comprising a handle and a pair of pivotally connected jaws with portions extending within the handle. One of the latter portions has an annular internally threaded part which engages an externally threaded part of a member within and secured to the handle. The latter member has an actuating member for swinging one of the jaws; this consists of a rod having a universal joint connection with the externally threaded part and a cap swiveled on the rod and having cam engagement with the last-mentioned jaw.

» «

Electrode Holder

2,372,113. **John Edward Opgenorth,** Oakland, Calif. Filed Aug. 28, 1943. Issued March 20, 1945.

A pair of jaws carried by a support are arranged for movement to receive and clamp a welding electrode between them. A shell of insulating material is fixed to and encloses one jaw and has an imperforate extension positioned to enclose the other jaw when the two are clamped together upon an electrode.

» «

Silver Solder

2,374,183. **George Durst,** Attleboro, Mass., assigned to **Metals & Controls Corp.,** Attleboro. Filed Oct. 9, 1943. Issued April 24, 1945.

A low-flow-temperature silver solder comprising by weight approximately 40-50% of silver, 15-19% of copper, 14-20% of zinc, 18-24% of cadmium and 0.1-5.0% total of tin and lead.

Resisto-Loy
HARD-SURFACING ALLOY

Contractors find that by hard-facing power shovel teeth with Resisto-Loy they last longer, wear down slower. By retaining their sharpness they dig faster, fill buckets quicker, increase output. Resisto-Loy is also extensively used to rebuild hammer-mill hammers. When hammers are hard-surfaced with this alloy they will break more material to size quicker, whether rock, sand, minerals or food stuff.

"Two-Tone" welding is for high speed repairing, rebuilding and hard surfacing on heavy duty equipment. Tractor driving sprockets which cost new $180 a pair can be rebuilt by the "Two-Tone" Process in 22 hrs. for $39, saving $141 and giving sprockets a life expectancy twice that of new parts. This new welding process holds a 3/32" Bare auxiliary filler rod between the work and a mild steel reverse-polarity arc-welding electrode. About equal amounts of electrode and rod are consumed, using about 30% extra amperage on welding machine. Electrode and rod mix together to give a high carbon, low alloy tool steel in grain, hardness, toughness and wear-resistance. An 8-page bulletin tells all about it. Want a copy?

"TWO-TONE" Welding

RESISTO-LOY COMPANY

•

GRAND RAPIDS (7), MICHIGAN